VOL. XXXI NO. 12 OCTOBER, 1938

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Section of Dermatology

President—H. HALDIN-DAVIS, F.R.C.S.

[*June* 16, 1938]

Premycosic Erythrodermia.—J. E. M. WIGLEY, M.B.

S. J. Y., male, aged 53, has had a dry scaling eruption since the age of 21. It varied in severity but did not itch. He understood it to be psoriasis.

About a year ago he had a " nervous breakdown ". From that time the eruption has become intensely irritable, more extensive, and persistent.

He was an in-patient at Birmingham General Hospital during August 1937, and Dr. B. C. Tate has told me that his condition was much the same as at present. No biopsy was made but a blood examination revealed no marked abnormality. Dr. Tate's diagnosis was then premycosic erythrodermia, but he had also considered a leukæmic infiltration.

Present condition.—A thin, rather worried, but otherwise fairly healthy-looking man. General physical examination revealed no gross abnormality apart from the skin. The eruption affects the scalp, face, trunk, and limbs. There are large areas of erythema broken up by irregular areas of normal skin. The erythematous areas feel thickened and in several places show a dry scaling not unlike psoriasis. There is a moderate degree of generalized adenitis. The irritation is intense, interfering with sleep, but apart from that the patient feels well. The Wassermann reaction is negative.

Blood-count (25.6.38): R.B.C. 4,740,000; Hb. 74%; C.I. 0·8; W.B.C. 18,800. *Differential:* Polys. 83%; lymphos. 11%; monos. 1%; eosinos. 4·5%.

A biopsy has been made and Dr. Muende's report is as follows :—

Over the zone of maximum cellular infiltration there is slight epidermal intercellular œdema, with immigration of leucocytes, absence of the stratum granulosum, and parakeratosis.

The papillæ are widened and result in the narrowing of the rete-pegs. The whole of the pars papillaris contains a dense cellular infiltration and the capillaries are widely dilated, possessing swollen lining cells. The cellular infiltration is composed of lymphoid cells, large mononuclears, plasma cells, neutrophil and eosinophil leucocytes.

The histology is very suggestive of early granuloma fungoides.

This confirms the clinical diagnosis of premycosic erythrodermia.

Two-thirds of a pastille dose of X-rays have been applied to the affected areas as far as possible. A differential blood-count on 14.6.38 showed W.B.C. 8,400; polys. 65%; eosinos. 8%. Either the X-rays or the rest in bed, or the two combined, have, within the last three weeks, relieved the irritation.

Hæmochromatosis in a Woman.—H. W. BARBER, F.R.C.P.

B. P., female, aged 43. No family history of significance. A hysterectomy was performed in September 1936, and soon afterwards general pruritus and darkening of the skin occurred, and the patient began to lose weight. Glycosuria was observed later.

Present condition.—Generalized bronzed pigmentation of the skin.

Liver palpable. Spleen not palpable. Blood-count not abnormal.

Glucose tolerance test: Fasting blood-sugar 0·17%; after one hour 0·23%; after two hours 0·21%. Chemical examination of stools: Normal. Diastatic index: 15 units. Fractional test meal normal. Wassermann and Kahn reactions negative.

The patient is being treated with insulin, but the urine is not yet sugar-free. There is no history of contact with copper.

Schamberg's Progressive Pigmentary Dermatosis.—H. W. BARBER, F.R.C.P.

Mr. C. J., aged 45.

The patient first began to take adalin in July 1937. The first patch of pigmentation in the skin appeared on the ankle some time in the autumn. During the last month he has taken adalin more frequently, and the eruption has spread widely. It now involves the left leg and thigh, the stump of his amputated leg, the buttocks and abdomen, and the forearms.

The case is shown as a probable example of an eruption, having the clinical appearances of Schamberg's disease, being caused by the ingestion of adalin. It is one of several observed by the exhibitor in which this drug was responsible for the eruption. In other cases, however, Schamberg's disease has apparently been caused by focal streptococcal infection.

I do not wish to raise a discussion as to the cause of Schamberg's disease in general, although I have my own views as to that, but I brought this patient here because I believe, although I have not proved it, that the eruption is probably due to adalin. In the first case under my care in which the eruption was due to adalin the patient discovered it for himself. He was a man who had had, I think, three—or certainly two—acute attacks of this pigmentary dermatosis, and I was so much interested in him that I asked Dr. Dowling to see him with me. After his second or third attack the patient said: "Do you think this is due to adalin? Every time I take adalin I get an attack." The eruption disappeared quickly when he ceased to take adalin, and I asked him if he would mind taking the drug again. He did so and had a characteristic attack. Since then I have had a few other cases.

Discussion.—Dr. F. A. E. SILCOCK said that during the past week he had had a patient, a man aged 62, who had a very marked eruption. He had been taking bromidia for some time every night, and had then begun to take adalin on account of auricular fibrillation, whereupon he exhibited this rash. The question was whether the dermatosis was due to adalin alone, or to a bromide plus adalin. Adalin was a benzene-ring derivative, and similar appearances did result from compounds of this class. The patient had given up the adalin and bromidia and had been put on a barbiturate, but it was too soon, as yet, to say what had happened.

Postscript (26.6.38).—After discontinuance of the adalin and bromidia the rash almost completely disappeared, fading gradually in a similar manner to that in which the rash in purpura died away.

Dr. F. PARKES WEBER said it seemed almost conclusive that in this case the eruption was due to adalin. The point about which he felt uncertain was whether the eruption ought really to be called Schamberg's disease. Professor P. Morawitz (*Sammlung von Vergiftungsfällen*, 1931, **2**, 71), had published a case of Majocchi's purpura due to the drug "Abasin". Drug-eruptions simulated various well-known purpuric, pigmentary, and erythematous conditions, but the question was whether Morawitz's abasin-eruption would have been admitted by Majocchi as an example of Majocchi's purpura, and whether Schamberg would have admitted Dr. Barber's adalin-eruption as an example of Schamberg's pigmentation.

Dr. L. S. KLEEBERG said that the first case of this kind had been published in 1930 by Habermann and Mulzer in Hamburg. He himself had seen three cases, one of them in a medical man, and all had presented the same picture. This form of skin eruption was certainly not an idiosyncrasy against bromide but was caused by idiosyncrasy against ureides with an open chain of carbon atoms. The doctor who had had this adalin exanthem was not sensitive to bromide.

Dr. I. MUENDE said that a clinical feature of the case under discussion which Dr. Barber had omitted to include in his description was that the rash extended above the pelvis but missed a band of skin which was covered by a tight pelvic belt supporting an artificial leg.

Dr. SILCOCK said that the patient whom he had described wore elastic stockings on account of varicose veins, and the eruption over the area of the stocking was distinctly modified. In that region it looked like follicular perniosis. Otherwise it was characteristic right up to the middle of the thighs and the forearms.

Dr. BARBER (in reply) said he did not think that his patient had been taking bromide—except that contained in adalin. In his view the eruption should not be called purpura. He was unable to distinguish the eruption in this case from what was called Schamberg's progressive pigmentary dermatosis. He was not suggesting that all cases of Schamberg's disease were due to adalin. He had seen some cases which seemed to be secondary to streptococcal infection.

Pustular Psoriasis.—H. W. BARBER, F.R.C.P.

Dr. J. B., aged 64. I am showing this case as an example of pustular psoriasis of the extremities, as compared with pustular bacteride.

As a child, the patient had recurrent severe attacks of tonsillitis, with high temperatures, and these continued until she was in the third decade. At the age of 23, she had an attack of "subacute rheumatism" with involvement of the joints and cardiac dilatation. She had been constipated all her life, and in 1920 had "colitis". In 1924 the eruption began as pustules or vesico-pustules on the palms and soles; she is quite certain that these were at first discrete and situated in normal skin—not, as now, in psoriasiform patches. She saw Dr. Sequeira who was apparently puzzled by the condition and gave her X-ray treatment. Within two or three years of the onset the present psoriasiform patches of the palms and soles developed, and non-pustular patches of psoriasis appeared elsewhere.

She has observed that after colonic irrigation the pustulation decreases for a while.

Present condition.—On the palms (chiefly the proximal halves) and on the soles are large areas of pustular psoriasis; the pustules and the brown spots, resulting from their desiccation, are numerous and for the most part are set in patches which are obviously psoriasis, but on the toes are some discrete pustules and brown spots set in apparently normal skin. The eruption on the soles, and to much less an extent on the palms, extends onto the lateral borders of the feet and hands.

Patches of ordinary non-pustular psoriasis are present on the front of the legs, right knee, left elbow, thighs, and scalp. The patient is edentulous and wears complete dentures. Tonsils small and buried ; contain definite pus.

Blood-pressure normal. Urine dilute ; no sugar or albumin. Abdomen rather distended and " doughy ".

The chief points of interest in the case are : (1) The long history of recurrent severe tonsillitis in childhood and early adult life. (2) The attack of articular rheumatism with myocardial, but no valvular, involvement. (3) The original development of the pustular lesions on the palms and soles, apparently in normal skin, and the subsequent development of psoriasis, which is pustular on the palms and soles, non-pustular and quite typical elsewhere.

If seen in the early stages, no doubt the eruption would have been diagnosed as " pustular bacteride " ; at present it is a characteristic example of pustular psoriasis. The case tends to confirm my present view, namely that there are two groups of cases in which this pustular eruption occurs : (1) Non-psoriatics in which the eruption corresponds to Clinton Andrews' pustular bacteride, and (2) psoriatics or potential psoriatics, in which the pustular eruption becomes, so to speak, engrafted on psoriasis. In the latter group the pustular eruption may appear first, as apparently in this case, and the psoriasis later, or vice versa.

Yellowish Discoloration of the Finger- and Toe-nails : Case for Diagnosis.—H. SEMON, M.D.

Mrs. M., aged 57.

The abnormal dirty yellow colour of all the nails of both hands (except 4th and 5th left), has been observed for about one and a half years, and there is nothing in the history to suggest a likely cause.

There will also be noted a considerable degree of transverse striation—multiple Beau's lines—rather more marked than usual.

The patient has been thoroughly examined for such possible abnormalities as hypercholesterolæmia, but there was nothing in the investigation or the history to suggest a blood cause for this peculiarity. The fungus examinations have proved negative. It occurred to me that we might here have an example of the absorption of a dye. The patient had been using " Inecto "—a hair-colouring preparation—for twenty years, and I asked Dr. Cox, a skilled analyst, to make an examination, but he was unable to detect anything suggestive of an aniline dye. This morning I applied a weak acetic acid and found that the colour came out, to a slight degree, on cotton-wool. I thought that this could only be due to some absorption from the stockings and gloves, but it would be an extraordinary coincidence that she should be absorbing some dye or colouring from stockings and gloves or shoes and gloves simultaneously. Dr. Cox was unable to find any trace of the chromium salt which, if the condition was due to leather, might be the explanation of the colouring.

Discussion.—Dr. TWISTON DAVIES said he had the impression that the nails were not only discoloured but were much thicker and that the dorsal surface had a greater convexity than was normal. The patient had told him that the nails very rarely needed cutting. He thought that the discoloration was due to the thickening of the nail-plate.

Sir ALDO CASTELLANI said that the condition seen in Dr. Semon's case was not extremely rare in the tropics. It had been described as long ago as 1909 by the late Dr. A. J. Chalmers and himself in the " Manual of Tropical Medicine ". Two varieties could be distinguished. In

one type fungi were found; a case of this kind had been described two or three years ago in the *American Journal of Dermatology*, but similar cases of the same origin had been found in Ceylon by Chalmers and himself. In the great majority of cases, however, fungus was not found.

Dr. R. T. BRAIN said that nails were frequently pigmented in icterus, and there appeared to be no reason why excess of other normal pigments, such as carotin and lipochrome, should not produce a similar effect to bile. He agreed with Dr. Twiston Davies that with a marked increase in the horny layer of the nail-plate or its matrix some yellowish discoloration was to be expected, as in tylosis.

Dr. SILCOCK said that in the dye-house of a large hosiery firm, the hands of several men employed in weighing out aniline dyes, developed all the colours of the rainbow successively or even at the same time; a noticeable feature was that the nails became very fragile and as thin as tissue paper, but there was, apparently, no distortion. He was asked by the firm if he could suggest a cause or a means of prevention. One young man whose nails were quite normal went into the dye-house and after a month or two his nails resembled those of the other men. The nails, however, did not become pigmented, and he wondered if the reason for this was the fact that after they finished their work the men washed their hands in a solution containing sodium hypochlorite. He had suggested a nail varnish, among other things, as a means of prevention. It was extremely difficult to get the chrome out of woollen yarn. Cases of suspected dermatitis due to stockings and underwear occasionally came forward, and the only way of getting out the chrome from the yarn, which was 99% keratin—very similar in composition to the nails themselves—was by ashing it and analysing the residue. He thought that chrome, on account of the difficulty of getting it out of woollen yarn, might be dismissed as a possible cause of nail discoloration from woollen gloves or stockings.

Dr. ELIZABETH HUNT said that she had seen two patients with discoloured finger nails somewhat similar to those of the patient under discussion. In both the discoloration had developed after the prolonged use of mercury preparations—in one case bichloride lotion, in the other mercuric ointments. Neither had shown the increased convexity and thickening of the nails seen in the present case.

Colloid Milium.—H. SEMON, M.D.

H. A., a farm labourer aged 40, has noticed a peculiar yellowish eruption in the neighbourhood of the orbits, and mostly to their outer sides, "since the War", i.e. for at least twenty years. There have been no subjective sensations at any time except occasional itching. There is no sign of any inflammatory reaction. The strictly symmetrical eruption consists of raised aggregations of innumerable firm translucent vesicles or papules, varying in size from a split pea to a pin's head—the latter being noted in abundance well away from the orbital margins and apparently encroaching on the temporal areas, where its progress can be noted with a hand lens, and from which a biopsy was taken. Incision and evacuation of one of the larger lesions yielded a clear yellowish-golden jelly-like substance—the "colloid" which gives the condition its name.

I am indebted to Dr. Muende who, with Dr. MacLeod and Dr. Wigley, published the first recorded case of the disease in this country[1] (*B.J.D. and S.*, **44**, 257–259, May 1932) both for the diagnosis and for the following histological report:—

The epidermis is thinned and the epidermo-dermal junction flattened, owing to the pressure exerted by the underlying colloid masses.

In the corium, and separated from the stratum germinativum by about 0·1 mm., there are large roughly spherical masses of degenerated collagen about 0·5 to 0·7 mm. in

[1] In that case the eruption was limited to the back of the hand.

diameter. The superficial half of the intervening zone appears to be normal but the lower half is composed almost completely of swollen, very wavy, degenerated elastic fibres, the product of which merges into the underlying colloid masses. The latter are composed of large swollen and fragmented blocks of collagen which have undergone a colloid degeneration and between them one can detect thin elastic fibres which stain poorly with the usual elastic stains.

The masses appear to be composed mainly of colloid degenerated collagen with a small proportion of elacin. The skin appendages and blood-vessels are not involved in this degenerative process.

Lichen Planus Confined to One Side of the Body and in a Segmental Distribution.—LOUIS FORMAN, M.D.

Female, aged 65.

Four months' history of sharply localized eruption, confined to right side of body. Eruption arranged in patches and streaks, and composed of papules of lichen planus, some arranged in circinate form, and distributed on the abdomen in the territory of the 10th and 11th dorsal segments. There is also a streak running around the back in this area, and streaks involving the 2nd lumbar and 8th cervical segments. However, this unilateral distribution is not seen in the mouth, where there is lichen planus on both sides of the tongue and on the mucous membranes of each cheek.

Discussion.—Dr. BARBER said that some years ago he had had a patient who was receiving injections of novarsenobillon, and one day came up complaining of intense pain around the flank, where, he said, a rash had developed. He (the speaker) had expected to find signs of an attack of herpes zoster, but when the patient undressed, a characteristic lichen planus with an exact zosteriform distribution was discovered. In these rare cases of lichen planus with such a distribution the onset was usually sudden, and the patient had pain which could be compared with that of herpes zoster.

Dr. P. B. MUMFORD said that he had published the details of a case very like this (*Brit. Journ. Derm. and Syph.*, 1930, **42**, 576). The patient, a young woman, had a zosteric form of lichen planus on one side of the trunk, one leg, and one arm. If the photographs were studied it would be noticed that the distribution on the arm and limbs was "herpetic". When he showed the photographs afterwards to his Professor of Anatomy he was informed that although they gave an impression of following the distribution of the superficial nerves, as a matter of fact they did not do so.

Dr. MUENDE said that he had examined the histology of a similar case which he had seen with Sir Ernest Graham-Little about seven years ago. He was surprised to find that in the small lichenoid papules the prickle-cells had undergone the various changes which were associated with herpes zoster, with the development of multinucleated cells and balloon cells, though there was neither vesiculation nor even any intercellular œdema. From the histological examination one could form the opinion that there was an epidermal reaction to a virus, but that this latter could not produce the œdema and vesiculation usually present in zoster.

Dr. BARBER said that lichen planus was probably a virus disease. Some years ago he had supplied material to Dr. Perdrau at the National Institute of Medical Research, in the hope that he might be able to produce lesions in rabbits. The experiments were inconclusive, but in monkeys they might have yielded more positive results.

Dr. BRAIN said that Dr. Barber had approached him some years ago with regard to the investigation of the same problem. He could only re-emphasize the great difficulty of investigating dry papules for the presence of virus. Extracts from such lesions made poor antigens for serological studies and the presence of inclusions and elementary bodies in compact cellular material was almost impossible to demonstrate. Further, animal inoculation often failed for lack of a susceptible animal, and for this reason it would be impossible in the case of zoster, a known virus disease, to demonstrate the presence of virus by such means.

The CHAIRMAN (Dr. H. MacCormac) said that it seemed to him that two different things were being discussed—lichen planus with zosteriform distribution, and a form of herpes zoster which mimicked lichen planus.

Dr. FORMAN said that it was well known that lichen planus appeared on any area of skin that had been inflamed or irritated. Perhaps in some of these cases of zosteriform lichen planus there might have been zoster previously, and a latent lichen planus have been localized to that area.

Two Cases of Dermatomyositis.—G. B. DOWLING, M.D.

I.—C. M., male, aged 40.

He attended St. Thomas's Hospital on April 30, 1938, complaining of generalized weakness and stiffness of the fingers. About two years ago he first noticed that the fingers went dead-white from time to time, especially in cold weather. Eighteen months ago the muscles began to grow stiff and he was becoming slow at his work; the weakness progressed, and eventually he became unable to work at all or to walk more than a short distance. His voice had changed, and he had difficulty in both talking and swallowing.

On examination.—Face rigid and mask-like, owing to scleroderma; fingers slightly flexed, owing to sclerodactyly. Skin over knuckles somewhat atrophic. Sclerodermatous change also on backs of hands, wrists, and extensor aspect of forearms. Marked muscular wasting of muscles about shoulder-girdle, biceps, forearms, and hands. Arm slightly flexed, owing to contracture of biceps. Voice nasal; speaking tires the patient. Difficulty in swallowing. Getting up from the ground can only be performed with help, although there is no sclerodermatous change on the thighs and legs.

Report on nasopharynx and larynx [Mr. W. A. Mill]: "Movements are impaired, and abduction is only half normal. On phonation, adduction is incomplete. There is a gap between the cords, the free edges of which vibrate, showing that they are not properly tensed—general weakness of laryngeal muscles. The pharynx and soft palate also seem weak."

Output of creatin in urine: 400–600 mgm. per day. The cutaneous changes are those of acrosclerosis (Sellei). The muscular symptoms are characteristic of dermatomyositis.

II.—Mrs. M. S. C., aged 55.

The symptoms began nine months ago with gradually increasing stiffness of the fingers, accompanied from time to time by Raynaud-like symptoms. During the same period a feeling of tightness of the lips developed. She has become progressively, though gradually, weaker. For six months she has had pain in the right thigh and finds it difficult to lie comfortably.

On examination.—Sclerodactyly and scleroderma of wrists and extensor aspects of forearms. Face rigid, owing to scleroderma; this change is also present in the neck and adjoining part of the chest and back. Although she is far less weak than the patient in the first case, she has obvious difficulty in getting up from the ground. The urinary output of creatin per day is 300–600 mgm.

In both these cases there is the same cutaneous picture, and both patients suffer from muscular weakness. There are some changes in the sugar metabolism in both—as in all the cases of dermatomyositis that have been under my care and under the care of my colleagues, the details of which will probably be published by Dr. Griffiths in due course.

These facts seem to point to two possibilities: (1) That the type of scleroderma named by Sellei acrosclerosis may belong, as he suggested, to a group separate from other sclerodermas. (2) That these cases may be related to dermatomyositis.

Dr. F. PARKES WEBER suggested that both these cases belonged to the class that had been generally described as symmetrical sclerodermia of the sclerodactylia type or, if one preferred it, of the "acrosclerosis type". These cases had occasionally presented a certain amount of deficiency in phonation, and this was very marked in Dr. Dowling's male patient. The soft palate might be occasionally involved in patients with sclerodermia.

With regard to local muscular weakness associated with sclerodermia, at a meeting of the Section in 1932, he had shown a woman with typical sclerodermia of the sclerodactylia type and with what he then supposed to be myasthenia gravis affecting the muscles of the back of the neck (F. P. Weber and O. B. Bode, *Proc. Roy. Soc. Med.*, 1932, **25**, 966). He had followed up this case, and, as the patient had not become worse, it was certainly not a progressive case of myasthenia gravis. Cases of symmetrical diffuse sclerodermia had been insufficiently examined as yet in regard to muscular weakness.

It was quite possible that the description of the cases which Dr. Dowling had given, namely, dermatomyositis, might turn out to be really correct, but he would be sorry to see them confused with typical cases of dermatomyositis, because they seemed to be totally different and to run a different course.

Dr. DOWLING (in reply) said that in all the numerous cases of dermatomyositis which Dr. Freudenthal and himself had examined histologically, the same change—namely sclerosis—had been found. Even in the most superficial cases, where the clinical changes resembled those of Jacobi's disease, the histological change had always been the same—a pure sclerosis without inflammatory alteration. He thought the differences might be only a matter of degree. A point in favour of the possible identity of acrosclerosis (or symmetrical scleroderma with sclerodactyly) with dermatomyositis was the distribution of the cutaneous changes, which was the same in both conditions, namely on the face, neck, forearms, hands, fingers, and, occasionally, the thighs and legs. Eventually it might be shown that the two conditions were of the same nature.

? Rosaceous Tuberculide: Case for Diagnosis.—F. JACOBSOHN, M.D.

The patient, a woman aged 45, complains of an eruption which has developed during the last nine months; it began on both sides of the face in the temple region and spread gradually downwards. There is marked irritation. For some time the patient noticed a rash on both arms; this disappeared without treatment. She has been taking a medicine for "nerves", but no medicine has been taken for the last three months.

Family and past history.—Nothing to report.

Present condition.—On either side of the face is a symmetrical acneiform eruption localized in front of the ears, and extending downwards to the region of the angulus mandibulæ, the forehead and the central parts of the face are not affected. A pustular eruption has appeared recently on the chin; it consists of red and brownish small papules which are not apple-jelly-like on vitropressure; some have a tiny yellow centre. There is some vascular dilatation of the whole affected area.

Biopsy (Dr. R. Klaber).—"No resemblance to lupus or rosaceous tuberculide, but the picture is consistent with bromide eruption."

Wassermann and Sigma reactions negative. Fractional test meal showed normal values of free and combined hydrochloric acid.

To exclude further the possibility of a bromide retention, the patient was given

for a week sodium chloride 1·0 grm. t.d.s. by mouth, but there was no improvement in the skin condition.

X-rays, ¼ B, given three times, at weekly intervals, lot. cal. co., with and without ichthyol 3%, haust. gent. c. rheo. alk. ½ oz. t.d.s., did not affect the rash either.

The serum bromide content was estimated on June 15 by Dr. G. H. Harrison (St. Bartholomew's Hospital Pathological Laboratory). He reported: Serum bromide 25 mgm. per 100 c.c. (normal range is up to 2·5 mgm. per 100 c.c.). The urine is free from bromides.

Comment.—In spite of the negative histological findings and the unusual localization, the possibility of a rosaceous tuberculide has still to be considered. The biopsy will be repeated and a Mantoux test carried out. X-ray examination of the chest and hæmatological examinations will be made. Since the patient has not taken bromide to our knowledge for some months, the diagnosis of bromide rash cannot be ruled out altogether, because it is conceivable that after such lapse of time the serum bromide may still be slightly raised.

Discussion.—Dr. SILCOCK said that in cases of bromide rash there would, as a rule, naturally be a low blood bromide content. These individuals were hypersensitive to bromide and therefore one would expect very little bromide in the blood, as against the individuals who stood up well to bromide and showed no rash at all.

Dr. MUENDE asked what test was used for the detection of bromide in urine. Belote's colour test, which depended on the conversion of fluorescein by bromide into tetra-brom fluorescein (eosin), was a very sensitive one and could probably detect bromide in dilution of 1 : 10,000.

Dr. JACOBSOHN (in reply) said that the tests for bromide in the urine had not been completed. They had been begun on the previous day and would be repeated by a method described by H. Ucko[1]. He could not believe that in cases of bromide eruption there would be a low content of serum bromide as had been suggested in the discussion. It was known that bromide was normally present in the serum, but it was still an open question as to what was the normal range.

Cutis Verticis Gyrata (Congenital).—SYDNEY THOMSON, M.D.

This child, a girl aged 1 year and 10 months, first attended hospital two days ago. The presence of the mole was noted at birth, and since that time it has only increased slightly in size, apparently in proportion to the growth of the patient. Both the shape and position of the lesion are somewhat unusual. It measures 1 in. in its longest diameter and ½ in. in width at the posterior end, tapering slightly anteriorly. The mole lies just to the right of and parallel to the mid-line of the skull, the anterior end almost touching the hair margin on the forehead.

Dr. F. PARKES WEBER said he thought that this case was deserving of some discussion. Such congenital cases certainly had given rise to very great confusion of terms; the striking "cutis verticis gyrata" which was occasionally associated with acromegaly was obviously of different nature and causation. He would suggest that in future the name "cutis verticis gyrata" might well be retained for cases like the present one of congenital and nævoid type. In certain cases which he had collected some time ago in the *British Journal of Dermatology* (1928, 40, 1), the essential change was an immense increase in the size of the scalp—an increase so large that the scalp had to become more or less folded over the bony surface underlying it. He would therefore suggest altering the terminology and calling

such cases "dermatomegaly of the scalp". It was known that in some cases of acromegaly one might have enlargement of the heart (or cardiomegaly), enlargement of the stomach (or gastromegaly), and enlargement of other viscera. Was it astonishing that in certain very rare cases of acromegaly the hormone from the eosinophilic cells of the pituitary body had the effect of producing an increase in the size of the scalp?

In the *British Journal of Dermatology* (1928, **40**, 454), with Dr. F. R. B. Atkinson, he had published a case of one-sided cutis verticis gyrata, and he had used that case to illustrate his theory that a hormone like that given off into the general circulation by the eosinophilic cells of the pituitary body, might in certain very rare cases produce its effect on only one side of the body. The reason he suggested was that the two sides of the body were occasionally of different "constitution", so that the one side reacted more easily than the other to the action of some hormone or other "agent" circulating in the blood (cf. F. P. Weber, *Med. Press. and Circ.*, 1927, **175**, 244).

Section of Urology

President—HENRY WADE, C.M.G., F.R.C.S.

[*May* 26, 1938]

The Pathology of Renal Lipomatosis

By C. E. DUKES, O.B.E., M.D.

THE name lipomatosis is given to an excessive deposition of fat. Lipomatosis of the kidney and ureter is one of the rarer consequences of calculous disease. It results in an excessive accumulation of fat around the region in which the stone is embedded and is usually accompanied by fibrotic atrophy of the kidney. Other names which have been used for this condition are—replacement lipomatosis of the kidney, lipomatous nephritis, lipomatous paranephritis, lipoma diffusium renis, substitutio renis adiposa, lipomatosis renis, fat replacement of the kidney, and fatty degeneration of the kidney (Kutzmann, 1931).

A consideration of the pathology of the lesion shows that some of these titles are unsuitable. Most of the recent cases have been reported as replacement lipomatosis, but we prefer lipomatosis alone because there is not always evidence of any replacement.

HISTORY

The first case of lipomatosis associated with calculous disease of which we have been able to find any trace in the English literature is one reported by J. H. Brown in 1861. This appears in the *Transactions of the Pathological Society of London*, under the title of "Adipose Transformation of the Kidney following Calculus and Abscess in that Organ". The author recognized the relationship between the stone and the "adipose transformation" and concluded his description with this observation:

> "Had the abscess healed up, the calculus having also disappeared in the discharges, its origin might not have been indicated or suspected."

There is no illustration in Brown's paper, but undoubtedly this was a genuine case of calculous lipomatosis.

The first actual picture of the condition that we have been able to find is in an article in the *British Medical Journal* in 1883, by E. Rickards, entitled "Remarks on Fatty Transformation of the Kidney". This is a description of a case of renal

lipomatosis following calculi, and the author refers to four cases previously reported, including Brown's. A coloured lithograph of the bisected kidney accompanies this article. This appears to be the first illustration of lipomatosis, for Rickards says :

> " It has not, as far as I am aware, been before portrayed, numerous and excellent as are the illustrations of the various morbid changes in the kidney by Bright and others."

We have not attempted to trace the earliest cases of this disease reported in other countries, but we have come across a good description in the French literature in a paper published by H. Hartmann in 1885 under the title of " Pyélite calculeuse et lipome du rein ". This paper gives references to several earlier cases.

During the last fifty years isolated cases of lipomatosis have been reported fairly frequently, and the disease has been reviewed in papers by Kutzmann (1931) and by Lieberthal (1935).

Source and Position of the Fat

The normal kidney is enclosed in a thin transparent capsule which is firmly attached to the renal tissue at the hilum. Surrounding this is a layer of perirenal fat, variable in thickness, which is loosely attached to the capsule and divided into lobules by thin connective-tissue strands. These extend to the peritoneum and to the retroperitoneal tissue and serve to support the kidney in position. These fine strands of connective tissue can easily be torn asunder, so that a normal kidney can be shelled out of its bed by blunt dissection. The perirenal fat extends over the renal pelvis and ureter, surrounding these with a fine coating of adipose tissue, though this is not always visible. In continuity with this a thin sheath of adipose tissue extends round the calices to their point of attachment to the renal papillæ. This peripelvic fat surrounds the blood-vessels at the hilum and may be traced along the arteries until they pierce the kidney.

Some degree of hyperplasia of this peripelvic fat may frequently be observed in pathological conditions resulting in shrinkage of the kidney, but it is by no means universal. The amount of fat present in this region can best be seen if the kidney is first fixed in formalin, then bisected and the whole organ stained with Sudan III, or scharlach R. Using this method, we have found that some degree of hyperplasia of the peripelvic fat is to be seen in all cases of calculi embedded in the renal pelvis, and is common also in chronic renal tuberculosis and pyonephrosis. The peripelvic fat is not increased in acute infections such as pyelonephritis or abscess, or in chronic Bright's disease, or in tumours of the kidney or renal pelvis, or in hydronephrosis of the pelvic type. Excessive hyperplasia of the peripelvic fat worthy of the name of lipomatosis has been found by us only in long-standing calculous disease of the kidney or ureter.

In lipomatosis there is an increase both of the perirenal and peripelvic fat, so that the kidney is embedded in a dense mass of fatty tissue. If a calculus is arrested in the ureter this organ may also become surrounded by a thick layer of fat. These excessive deposits of fat have the same chemical composition as normal fat, but the adipose tissue of lipomatosis differs from the normal perirenal and peripelvic fat in its physical structure. Whereas the normal fat is friable and easily divided, the fat in lipomatosis is tough and fibrous. This is due to a thickening of the connective tissue which normally divides the fat into lobules and unites the renal capsule to the peritoneum and retroperitoneal fasciæ. The fibrous thickening is the result of inflammation, an indication of which is seen in microscopic sections by cellular infiltrations of the fine fibrous septa and active proliferation of fibroblasts, with formation of collagen. A proliferation of fibrous tissue is also found within the

kidney in lipomatosis and this also is the result of infection. It may be of such a degree as to justify the description " fibrosis " or " fibrotic atrophy ".

A striking feature in renal lipomatosis is the sharp line of demarcation between the fat and the renal parenchyma. This was noticed by Bacon and LeCount (1928), who concluded that there was no real invasion of the kidney by fat but only a replacement, the fatty tissue multiplying to fill the space left by the atrophied kidney. This was also the opinion of Rickards, who wrote in 1883:

> " Whatever be the source of the fat there can be no doubt that it is not degenerated renal parenchyma and it is equally certain that the fat does not stamp out renal disease. It seems probable that the fat is developed to fill up spaces created by the breaking-down and discharge of renal substance and that the process is one of physiological compensation, an effort to prevent a vacuum."

This conclusion is reached also by most subsequent authors who have written about renal lipomatosis, particularly Gimpelson (1929), Kretschmer and Pierson (1932), White and Cambridge (1934), and Exley and Devereaux (1935).

Before deciding whether or not this explanation alone is sufficient, it is of interest to consider the conditions under which lipomatosis may occur in other organs of the body. Matsuoka (1915), who made a special study of this question, distinguished two different types or groups of lipomatosis. The first group includes those cases of lipomatosis in which the invasion of the adipose cells from the surrounding into the affected tissue is the essential feature, whilst the proliferation of fat cells in the interstitium of the affected organ only plays a minor role. It might be described as fat invasion. This type of lipomatosis is found in many organs of the body in general obesity, or it may affect single organs such as the heart, pancreas, mammary glands, or large intestine. In the second group the lipomatosis may occur after a primary atrophy of the parenchyma. This atrophy is followed by fibrosis and the new connective-tissue cells become infiltrated with fat droplets. In this group there is no invasion from without; the lipomatosis is the result of fat formed locally within connective tissue cells. The process may be described as replacement lipomatosis. It is most frequently seen in patients suffering from wasting diseases such as tuberculosis or cancer. Renal lipomatosis secondary to calculous disease is usually associated with atrophy and fibrosis of the kidney, so that it might be expected to provide an example of the second type of lipomatosis, namely the development of fat in the newly formed fibrous tissue as a replacement lipomatosis. If this occurs it is of relatively slight importance and provides only a small contribution to the great mass of fat which comes to surround the stone, because sections of the kidney in cases of lipomatosis do not show any more fat than is usually found within kidneys exhibiting fibrotic atrophy due to other causes.

Renal lipomatosis has more in common with Matsuoka's first group, in which the invasion of adipose cells from the surrounding into the affected tissue is the essential feature. The fat certainly appears to invade the kidney along the blood-vessels, starting from the peripelvic fat. A similar invasion of the kidney by the perirenal fat cannot occur, because the kidney capsule, with its dense areolar tissue and elastic fibres, presents a barrier through which the fat cannot pass. But there is no such obstacle to bar the invasion of the peripelvic fat, which pushes its way into the cracks and crevices surrounding the blood-vessels.

Since the fat is derived from normal peripelvic fat, the most reasonable explanation of lipomatosis seems to be that the stone stimulates the proliferation of the fat-forming tissue in its proximity. The fatty overgrowth is advantageous, because it provides a cushion or buffer, thus diminishing the injury from the friction between the stone and its immediate surroundings. The fat may be likened to a cotton-wool

packing. The lipomatosis is a protective mechanism which performs a useful function. When the stone has become fixed and there is no longer any hope of getting rid of it, Nature decides to do the next best thing and bury it alive.

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Clinical Significance of Lipomatosis of the Kidney and Ureter

By A. W. BADENOCH, M.D., F.R.C.S.

CHANGES in the deposits of fat in and around the kidney and ureter have been arranged in the following three groups: (1) When there is a simple hyperplasia of the peripelvic and peri-ureteric fat. (2) When there is a moderate increase in the fat of the renal sinus (early lipomatosis). (3) When there is an excessive deposit of fat in the renal parenchyma and around the pelvis (advanced lipomatosis).

These groups merge into each other, and the classification must necessarily be somewhat arbitrary. For this reason, cases are placed in Group 3 only when there has been marked excess of fat (*see* fig.), and it is with this last group, advanced lipomatosis, that this communication is concerned.

The condition was recognized and reported on not infrequently during the last century, but all the cases had been discovered at autopsy. In 1901, Israel described the first one in which the kidney had been removed at operation. Since then, a considerable number have been reported, but the condition is comparatively rare.

For the purpose of this communication, a study has been made of nine cases of advanced lipomatosis from the pathological department of St. Peter's Hospital. Eight of these were associated with calculus.

NINE CASES OF ADVANCED LIPOMATOSIS.

Age	Sex	Duration of symptoms (years)	Side	Composition of stone	Infection	Site
53	F.	20	R.	Phosphate	Gram + cocci Gram − bacilli	Kidney
	M.	Many			+	Kidney
41	M.	8	R.	Phosphate	*Staph. albus*	Kidney
62	F.	Some	R.	Phosphate	*B. coli*	Kidney
66	F.	20	R.	Phosphate	*B. coli*	Kidney
54	F.	Not stated	R.	Phosphate	*B. coli*	Kidney
42	M.	12	L.	Oxalate	Gram + cocci Gram − bacilli	Kidney and ureter
47	F.	10	R.	Phosphate	*B. coli and Staph. albus*	Kidney and ureter
58	M.	9	R.	Phosphate and oxalate	*B. coli*	Kidney and ureter

In those accompanied by stone formation, five were in female patients and three were in male. The youngest was aged 41, and the eldest 66. The duration of symptoms referred to the urinary tract was stated in six of the eight cases. The longest period was twenty years (in two of the cases), and the shortest eight years.

This is not surprising if the view is correct that the process is gradually progressive from the hyperplasia so frequently met with in certain pathological conditions of the kidney. In seven of the eight patients, the right side was affected. This is almost certainly of no significance in such a small series and there appears to be no reason why the right kidney should be more liable to the condition. In six cases the calculus was composed of phosphate, in one of phosphates and oxalates, and in another of pure oxalates. The condition was confined to the kidney in five cases. The ureter was also affected in the other three. Infection was present in each instance, being mixed in three out of the eight cases.

Showing well-marked lipomatosis of kidney and ureter.

The ninth patient had an old-standing urethral stricture following gonococcal urethritis. The kidney was found to be almost functionless, and was the site of severe urinary infection.

These clinical findings are similar in many respects to those of the series reviewed by Kutzmann. When reporting a case, Kutzmann analysed a further 32 from the literature. The age distribution varied widely from 11 to 67 years. The distribution was almost equal as regards side, for in the cases where this was mentioned, 12 were right, 13 left, and three bilateral. There was a slight preponderance of females (15 females to 12 males). All presented urinary infection. Young, in reporting

a series of 12 cases, mentions one with neither stone nor infection. This appears to be the only case of its kind on record.

Clinical course.—The clinical course is always that of a very chronic urinary infection, generally accompanied by stone. In none of the cases reported to-night was the lipomatosis diagnosed prior to operation. The clinical picture is always dominated by the accompanying calculus and infection. In every patient the affected kidney was functionless, or practically so, and was causing either pain or discomfort. One had a kyphosis of the lower dorsal spine, following a tuberculous lesion in childhood; otherwise nothing abnormal was found on general examination.

Diagnosis.—The diagnosis cannot be made except by exploration of the organ. There are no pathognomonic symptoms or signs.

Treatment.—The treatment of lipomatosis of the kidney or ureter does not arise *per se*. Since, however, the kidney is usually painful, functionless, and infected, a nephrectomy should be performed if there is no contra-indication. The operation may be extremely difficult, and it is this factor which, in the main, gives the condition surgical interest.

As has already been indicated, the lipomatosis is always associated with hyperplasia of the peripelvic—and, usually, perinephric—fat. The latter is densely adherent, both to the viscera and the parietes, and may even involve the peritoneum and related large bowel. The exposure of the organ is therefore very difficult, and may be extremely tedious. The various components of the hilum of the kidney are matted together and difficult to differentiate. Accurate dissection is often impossible, so that it is frequently necessary to ligature a large pedicle. The pedicle, however, is stout, and since it is not unduly friable, the ligature usually has a good grip. Similar considerations present themselves in dealing with the ureter, and here also the application of the ligature may be difficult.

The convalescence is that after nephrectomy for any condition. All the patients in this series made a satisfactory recovery from the operation.

[My thanks are due to the Honorary Surgeons to St. Peter's Hospital for allowing me to analyse these cases, and especially to Mr. Swift Joly for his help in a case from his private practice, and to Mr. Ogier Ward for a case operated on at Mount Vernon Hospital.]

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Posterior Urethral Obstruction in Childhood

By WILFRID SHELDON, M.D., F.R.C.P.

THE title of this communication implies that it is concerned only with male children. Organic obstruction in the female urethra is indeed a rarity, at any rate in childhood; I have had no personal experience of a case, nor is there a proven instance among the museum records of the Hospital for Sick Children. My remarks are intentionally limited to disorders of the posterior urethra, thereby omitting discussion of that interesting group of cases in which dilatation of the bladder and bilateral hydronephrosis is associated with no discoverable obstruction at post-mortem examination, and which is ascribed to some neuromuscular inco-ordination of the vesical sphincter, analogous to the condition found in Hirschsprung's disease.

The principal cause of obstruction in the posterior urethra in childhood lies in some type of valve formation of the mucosa, but mention must first be made of hypertrophy of the verumontanum, to which attention was drawn by Bugbee and Woolstein in 1923. These authors recorded five examples of this condition in children whose ages ranged from 13 days to 3½ years. The symptoms and pathological changes in the urinary tract above the level of obstruction are identical with those caused by urethral valves and so will be considered later.

If we may judge from the relative numbers of recorded instances, hypertrophy of the verumontanum is a much less common cause of urethral obstruction than are valves, but the degree of obstruction may be equally severe, as may be gathered from the young age at which death occurred and from the degree of change wrought in the upper urinary tract.

Urethral valves.—Although occasional reports of urethral valves have appeared in medical literature for more than a century, the paper by Young, Frontz, and Baldwin, in 1919, was the first exhaustive study of the subject. These authors were able to collect 24 cases from the literature and added 12 of their own. Since their communication less has been heard of idiopathic dilatation of the bladder, while the number of recorded instances of urethral valves has risen steeply. The first case was reported as long ago as 1802 by Langenbeck in his *Mémoire sur la Lithotomie*. In this country the first instance was recorded by Mr. Morton of Bristol in 1904, concerning an infant of 13 months, the second, in an infant aged 14 months, was reported by Mr. Thompson of Devonport in 1907, and the third, in a boy aged 3 months, was described by Dr. Morley Fletcher in *St. Bartholomew's Hospital Reports* in 1908. The contribution by Young and his co-workers marked a definite stage forward, in that for the first time the condition was diagnosed during life, and resort was made to operative measures, in some cases with success.

Young has classified urethral valves into the three following types :—

Type I : In this, the most common type, there is a crest lying on the floor of the urethra and running distally from the verumontanum. The crest bifurcates into two ridges, each rising upwards and forwards to join the roof of the urethra in the region of the membranous portion. On the outer side of each ridge is a membrane continuous with the lateral wall of the urethra, thus forming a blind cul-de-sac through which urine cannot pass to the penile urethra. The only passage for urine lies in the small gap between the two ridges, and should the ridges fuse together before reaching the roof of the urethra, this gap may be little more than a pinhole opening.

In one of the specimens shown this evening there is a further modification of this type of valve. The two ridges have not actually fused, but the gap is reduced in size by a curtain of tissue stretched between them, and extending from the roof of the urethra nearly down to where the crest has bifurcated.

Type II : This is similar to the first type, except that the crest, bifurcating into two ridges, runs from the verumontanum towards the bladder instead of towards the membranous urethra.

Type III : This is quite different from the previous types, and bears no connexion with the verumontanum. It consists of a perforated diaphragm stretched across the urethra. According to the size and position of the perforation, this type of valve may appear like the shutter of a camera or may be little more than a crescentic fold.

Table I sets out the particulars of the 13 cases I am reporting. Cases 1 and 5 are from the Children's Department, King's College Hospital, the remainder are from the Hospital for Sick Children, Great Ormond Street. Cases 2 (1928), 12 (1927), and 13 (1935) have previously appeared in the literature. All the cases proved fatal.

TABLE I.

Case No.	Age	Symptoms	Clinical examination	Treatment	Type of valve (Young's classification)	Remarks
1	10 days	Abdominal distension noted from birth	Distended bladder Both kidneys palpable Albuminuria and hæmaturia	Ureteric catheter tied in bladder	I	Died 2 days after admission
2	19 days	Abdominal distension noted from birth. Urine escaped drop by drop	Distended bladder Albuminuria and hæmaturia	Catheterized daily from 12th day	I	Reported in *Lancet*, 1928
3	4 weeks	Abdominal distension noted from birth	Distended bladder Both kidneys palpable Urine sterile Bl. urea 280 mgm. per 100 c.c.	Catheterized	I	—
4	5 weeks	Abdominal distension noted from birth	Distended bladder Both kidneys palpable Pyuria Bl. urea 71 mgm. per 100 c.c.	Cystotomy. De Pezzer catheter tied in	I	—
5	5 weeks	—	Distended bladder	—	I	Brought moribund to hospital
6	7 weeks	Vomiting for 3 days. Difficulty in voiding urine	Distended bladder Both kidneys palpable Pyuria Bl. urea 330 mgm. per 100 c.c.	Attempts to pass catheter failed	I	—
7	8 weeks	Projectile vomiting from birth	Distended bladder Pyuria	—	III	—
8	12 weeks	Difficulty in voiding urine from birth	Distended bladder Both kidneys palpable Pyuria Bl. urea 143 mgm. per 100 c.c.	Catheterized without difficulty. Cystogram and reflex pyelogram obtained	I	—
9	14 weeks	Admitted to surgical ward for abdominal colic. No urinary symptoms	—	—	I	Died suddenly 4 days after admission
10	16 weeks	Hæmaturia for 2 days		—		Arrived moribund. Died a few minutes after admission
11	1 year	Vomiting, dysuria, frequency and fever for 1 month	Bladder not felt L. pyonephrosis Bl. urea 187 mgm. per 100 c.c.	L. kidney opened and drained	I	—
12	2 years	Urine always voided in a dribble. Vomiting recently	Distended bladder Previously diagnosed as diabetes insipidus Albuminuria Urine sterile Bl. urea 109 mgm. per 100 c.c. Bl. Ca 7·8 mgm. per 100 c.c. Bl. P. 11·0 mgm. per 100 c.c.	Unable to pass catheter	I + curtain (*see text*)	Reported in *Arch. Dis. Childhood*, 1927
13	9 years	Thirst, polyuria, knock knee. Nephritis diagnosed at 3 years	Renal rickets Bl. urea 225 mgm. per 100 c.c. Bl. Ca 3·84 mgm. per 100 c.c. Bl. P. 10·4 mgm. per 100 c.c.	—	I	Reported in *Lancet*, 1935

Age.—Of the 13 cases, no less than 10 infants died within four weeks of birth. Even in the youngest of these the destructive effect of the urethral obstruction on the kidneys had reached a remarkable degree, so much so that even had it been possible to destroy the valves it is unlikely that life would have been materially prolonged. The gross changes in the urinary tract in these young infants could not have come about merely since birth, but must have been developing for some months before parturition; in fact we have in this disorder convincing evidence that the normal fœtus voids urine. It would be of interest to know whether oligamnios is usual at the birth of these infants, but I have no data on that point. The youngest instance on record is Fuch's case, which occurred in a 5-month fœtus; the valve was of the first type, and already, at so young an age, the bladder was hypertrophied, the ureters were dilated and tortuous, and hydronephrosis was present.

There can be little doubt that the degree of obstruction caused by urethral valves varies considerably, for in older children the back-pressure effects of the stasis of urine on the ureters and kidneys is much less severe. This variation is also reflected in the age to which the patients may survive, for in his analysis of 34 cases taken from the literature, Young found the oldest example in a man aged 85 (Iverson). Hinman and Kutzmann (1925) recorded an example in a man aged 57, and one of Young's patients was a man aged 42. Of the 34 cases, only 12 patients failed to survive their first year, while 13 lived beyond five years. This is a very different age incidence to that of the cases shown to-day, but this difference may be accounted for in part by the fact that the Departments from which these cases are drawn only receive patients up to 12 years of age. On the other hand, I know from my own experience that even at autopsy it is easy to overlook the presence of a urethral valve, especially perhaps in small infants, a fact which offers some explanation for the small number of case records until within recent years.

Symptoms and physical signs.—Table II shows an analysis of the symptoms for which the children were brought to hospital, while Table III sets forth the physical signs.

TABLE II.—SYMPTOMS.

	Cases
Abdominal distension (noted from birth)	4
Dribbling incontinence of urine	4
Vomiting	4
Hæmaturia	1
Pain on micturition	1
Abdominal colic	1
Thirst, polyuria, knock knee	1

TABLE III.—PHYSICAL SIGNS.

	Cases
Distended bladder	9
Palpable kidneys	6
Urine—albuminuria	9
hæmaturia	2
pyuria	5
sterile	2
Renal rickets	1

In infancy the most likely reason for medical advice being sought is abdominal distension, and in carefully-observed cases this may have been noticed right from birth. The distension is due principally to the dilated bladder, which may reach even above the umbilicus and, although varying in size from day to day, is persistently palpable. It has also an unusually firm feeling, due to the hypertrophy of its muscle, reminding one of a 4- or 5-month pregnant uterus. If the orifice in the valve is minute, or is situated eccentrically, it may be difficult or impossible to pass a

catheter into the bladder, but as a rule catheterization can be managed without difficulty. Even when the bladder has been emptied in this way it may still be palpable, owing to the thickness of the muscle, and it quickly distends again. It should be emphasized that the fact that a catheter can be passed in no way disproves the presence of a valve. On the other hand, retrograde catheterization from the bladder down the urethra after cystotomy is usually impossible, nor can it be carried out at post-mortem examination.

To a much less extent the abdominal distension is in part due to the bilateral hydronephrosis, which may be sufficient to give a palpable mass in each loin. The kidneys are most likely to be felt in the patients who die during infancy, indeed i the conception be correct that there is a direct relation between the length of life and the degree of obstruction caused by the valve, it follows that the older the patient the less will be the degree of hydronephrosis.

Another characteristic symptom lies in the dribbling incontinence of urine. The stream of urine is weak and only brought about by a severe effort on the part of the child ; in fact, even with the aid of straining, the stream may be little more than drop by drop. The child is, however, constantly wet, and although this may not cause much comment in young infants, older children may be brought to us on account of enuresis. These differ, however, from the common bed-wetting child, in that the enuresis is diurnal as well as nocturnal. A mistake is hardly likely to arise if the rule is made to examine all cases of enuresis for distension of the bladder ; a combination of incontinence and a palpable bladder is at once a warning that the enuresis is more likely to be organic in origin than functional, and should lead to a thorough urological investigation.

Abdominal pain, or pain on attempting to pass urine, is not a prominent symptom. It could, of course, be more easily recognized in older children than in infants, but by that time the chronicity of the condition may tend to dull this symptom.

The effect of the prolonged back pressure on the kidneys is to give rise to chronic nephritis, and therefore the symptoms of uræmia are likely to be met with, the most prominent in infancy being intractable vomiting. In one case this was projectile in character, simulating that in hypertrophic stenosis of the pylorus. There may also be a troublesome diarrhœa, which in combination with vomiting may well lead to a mistaken diagnosis of a primary gastro-enteritis.

During childhood prolonged disturbance of function of any important organ commonly interferes with growth, and chronic nephritis is no exception. This is shown in Table IV, which gives the weight and height of the three children who died at the ages of 1, 2, and 9 years. The normal weight and height are given in brackets. Case 13, in addition to severe stunting, showed also the bone changes of renal rickets.

TABLE IV.

	Age at death	Weight (lb.)	Height (inches)
Case 11	1 year	13 (21)	—
Case 12	2 years	17 (27)	30 (33)
Case 13	9 years	37 (60)	42 (50)

In most cases infection of the urinary tract eventually occurs, and the symptoms that then arise may bring the child under medical observation. Thus in acute cases high fever, chills, vomiting, convulsions, and anorexia may be prominent, or if the infection passes into a chronic stage there may be recurrent bouts of temperature, loss of appetite, anæmia, and progressive wasting.

In most cases the urine contains albumin and, towards the end of the illness, blood as well, arising presumably from the hæmorrhagic cystitis which is so often found at

autopsy. With the advent of infection pus appears in the urine, and a positive culture of *B. coli* in association with other pyogenic organisms may be obtained.

Biochemical findings.—The few investigations that have been carried out have confirmed the presence of renal failure. Thus the blood urea estimated in seven of the cases, has ranged from 77 mgm. to 330 mgm. per 100 c.c. In the two eldest children aged 2 years and 9 years, the blood-calcium has been 7·8 mgm. and 3·84 mgm. per 100 c.c. of serum, and the blood phosphorus has been 11 mgm. and 10·4 mgm. per 100 c.c. of serum respectively. In the former child the urea-concentration test did not rise above 0·95, and in the latter (the child with renal rickets) the phosphatase was estimated at 24 units.

Diagnosis.—In the majority of cases the clinical picture is so clear-cut that a diagnosis of urethral valves should be made during life, without difficulty. The most characteristic feature is a persistently palpable bladder. In an infant, this may be associated with a history, dating from birth, of abdominal distension, and also perhaps of difficulty in urination, while an older boy may be brought for enuresis. Alternatively the child may be first seen with the symptoms of uræmia, or because of infection of the urinary tract, but in either case the distended bladder should act as a warning of the possibility of urethral valves. Occasionally an obstruction is found when catheterization is attempted, although an easy passage of a catheter in no way excludes a valve. In older children direct urethroscopy may enable the obstruction to be seen. Cystoscopy will show dilatation and trabeculation of the bladder, dilatation of the ureteric orifices, and distension of the posterior urethra, and this may be confirmed by X-ray examination after filling the bladder with a sodium iodide solution or other solution opaque to X-rays. Not infrequently the ureteric orifices into the bladder are so much dilated that if the child is tilted in the Trendelenburg position, the fluid may flow in a retrograde direction and outline the dilated ureters and renal pelves, and thus some estimate may be formed of the degree of distortion of the upper urinary tract.

Morbid anatomy.—The various types of valvular obstruction have already been described. The other changes in the urinary tract result from the back pressure of accumulating urine, often combined with changes due to infection.

The *bladder* at post-mortem examination is to some extent dilated, but the outstanding feature is the remarkable hypertrophy of the muscle, the whole bladder being uniformly thickened. There may be trabeculation and diverticulation. Often there is hæmorrhagic cystitis. The prostatic urethra is dilated down to the point of obstruction, and the vesical bar is thrown into prominence.

Both the ureters are so elongated, dilated, and tortuous, that almost all observers point out their resemblance to small intestine. It is of interest that although the uretero-vesical orifices may be so much dilated during life as to allow of reflux of fluid from the bladder, at autopsy they are contracted and usually appear of normal calibre.

Both kidneys show a variable degree of hydronephrosis, this being relatively more severe in infants and young children. The kidney substance is much reduced in amount, and on microscopical examination shows an advanced degree of renal fibrosis. If infection has occurred the kidneys will, in addition, be riddled with small abscesses.

Treatment.—The treatment of urethral valvular obstruction lies in removal or destruction of the valves. This is purely a surgical manœuvre and lies outside the province of the physician, therefore I shall not presume to discuss it, preferring to leave that aspect of the subject to the members of this Section. These children are, however, likely to come in the first place to the pædiatrician, and it is therefore essential that the physician should be alive to the existence of these deformities;

that is why in this communication I have concentrated upon the symptoms, physical signs, and morbid anatomy of the condition. Although in many instances the changes in the urinary tract have reached so gross a degree at such an early age as to render the prognosis wellnigh hopeless, in the less severe cases an early diagnosis and immediate collaboration with a urologist give the child a prospect of recovery, and it is in this way that the physician can play a useful part.

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Section of Odontology

President—FRANK J. PEARCE, L.D.S.E.

[*May* 23, 1938]

Remarks on Certain Neolithic Skulls

By A. J. E. CAVE, M.D., F.R.A.I.

IN 1936 Messrs. Alexander Keiller and Stuart Piggott, of the Morven Institute of Archæological Research, excavated a megalithic tomb of neolithic date (i.e. 2000–1000 B.C.) situated in the northern side of the Lanhill Long Barrow, Wiltshire (see *Proceedings of the Prehistoric Society*, 1938, No. 5, 122–131). This sepulchral chamber, a family burial vault, contained a great mass of human bones—one skeleton (the last interment) lying immediately within the chamber, the remains of several previous burials being piled up at its back. The bones were removed to the Museum of the Royal College of Surgeons of England and, after sorting, were resolved into the remains of nine individuals, as follows :—

Lanhill 1.—Male, 50–60 years ; height about 5 ft. 4½ in. (Skull and most of skeleton.)

Lanhill 2.—Female, senile : height about 5 ft. 3½ in. (Skull and incomplete skeleton.)

Lanhill 3.—Male, 30–40 years ; height about 5 ft. 8 in. (Incomplete skull and skeleton.)

Lanhill 4.—Child, ? sex, 12–13 years. (Skull, and incomplete skeleton.)

Lanhill 5.—Female, 30–40 years ; height about 4 ft. 11 in. (Calvarium, mandible, vertebræ, pelvis and long bones.)

Lanhill 6.—Male, 30–35 years ; height about 5 ft. 8 in. (Incomplete.)

Lanhill 7.—Male, 50–60 years ; height about 5 ft. 4 in. (Skull and skeleton.)

Lanhill 8.—Male, about 20 years, (No skull—axial skeleton and certain long bones only.)

Lanhill 9.—Baby, about 12 months old. (Portion of right femur.)

Historical Age

The Lanhill people flourished in the so-called Neolithic period, which began in Britain approximately about 2000 B.C. and probably lasted for one millenium at least. These people were agriculturalists, cultivating cereals extensively, possessing flocks and herds of cattle, sheep and swine, and burying their nobility in megalithic tombs of characteristic pattern.

Racial Type

The individuals interred in the Lanhill Long Barrow are all excellent examples of Sergi's " Mediterranean " (= Elliot Smith's " Brown ") race ; they display a homogeneity of anatomical characters devoid of any discernible admixture of alien traits.

Stature.—They were people of small stature, distinctly smaller than the average modern Briton (who is about 5 ft. 10 in.). Of the adult males, two (Nos. 3 and 6), the tallest individuals in the group, have an estimated height of 5 ft. 8 in., but two others (Nos. 1 and 7) attain no more than 5 ft. 4 in. or so. This last figure is the approximate stature of the elderly woman (No. 2) ; the younger mature woman (No. 5) is even shorter—not more than 4 ft. 11 in.

Crania.—The skulls are of characteristic configuration. They are thin-walled, long, and pentagonal or ovoid when viewed from above or behind ; their supra-inial region protrudes as a rounded emphatic " boss " ; the brow is rounded, smooth, and vertical ; supra-orbital eminences are but moderately developed, even in the men. The smallish, sharp-rimmed orbits are roughly rectangular in outline, with parallel upper and lower margins, and the malar regions are flattened laterally. The face is small, straight, and narrow, with slight subnasal prognathism ; the root of the bony nose is depressed and the nasal bridge moderately prominent ; the nasal cavities are narrow and the anterior nasal spine is particularly prominent. The canine fossæ are emphatically pronounced ; the teeth are medium-sized and the bite is of the " edge-to-edge " variety. The mastoid processes are pneumatic ; the accessory nasal sinuses (maxillary, sphenoidal, &c.) are extremely capacious. In female and adolescent skulls there is an approximation to the so-called " Grecian profile ", i.e. the profile of the brow continues uninterruptedly into that of the nasal bridge.

Habit.—Presumptive evidence of righthandedness is seen in the particular form of natural asymmetry of the occiput (the left moiety of the occipital " boss " being displaced further posteriorly than its fellow) and in the general greater manifestation of muscular and other secondary markings upon the bones of the right arm and shoulder girdle. Where comparison is feasible (Nos. 5 and 6) there is, as anticipated, an absolute preponderance in length of the right humerus.

Skeleton

The symmetry of cranial form and the almost " effeminate " gracefulness of the general skeleton is striking. The various bones are of smallish size : they reveal an excellent firm grain and texture, and a characteristic gracile architecture. Secondary markings, though readily discernible, are generally of minimal exuberance, and even where pronounced, do not mar the uniform harmony of skeletal structure and proportion. The articular ends of the long bones are characteristically neat and well formed, suggesting, with their adjacent ligamentous markings, a constant and considerable employment and a full amplitude of movement during life.

Platymeria and platycnemia are pronounced throughout the series, and there is a concomitant (though less easily assessed) generalized flattening of the upper limb bones.

The hands and feet appear to have been small and delicately fashioned. The vertebræ and ribs are small-sized, of excellent osseous texture, and (save where diseased) of a characteristic neatness of build.

Familial Relationships

That the Lanhill Long Barrow skeletons represent the several members of one particular family group is obvious on various grounds—the mixture of sexes and ages, and the succession of burials in the Barrow. Moreover, a distinct family resemblance is anatomically apparent between certain members of this group, and it

is very possible, although no certainty can be reached on the point, that skulls Nos. 1, 3, and 7, are those of brothers. The younger woman (No. 5) may well be the daughter of the aged female (No. 2), and further—though, again, no certain opinion is possible—it is quite likely that the youth of 20, the child of 12, and the year-old baby, are her children.

Another curious bit of evidence indicating familial relationship is the frequency of Wormian ossicles at the lambdoid in these Lanhill crania. Thus No. 1 has a large (florin-sized) lambdoid Wormian ossicle representing morphologically an interparietal; No. 3 shows a curious irregularity of lambdoid sutural pattern with a tiny Wormian in the hind end of the sagittal suture; No. 4 has a tiny Wormian exactly at the lambda; No. 5 is devoid of sutural ossicles, but manifests the attempted formation of two such in the left parieto-occipital suture; No. 6 shows a tiny Wormian situated precisely at the lambda; Nos. 2 and 7 reveal a normal lambdoid suture pattern.

Anatomical

Skeleton No. 6 shows the interesting and not infrequent anatomical variation of unilateral sacralization of the 5th lumbar vertebra. The condition is congenital, and in this instance the sacralization is by diarthrosis and not by synostosis; it appears to have been wholly symptomless.

This same individual presents an unusual skeletal variation—adventitious epiphyses on the roots of the scapular spines.

Skeleton No. 1 has the mental foramen double bilaterally. Skeleton No. 8 (the 20-year adolescent male) reveals early fusion of the epiphysis for the iliac crest. In each innominate bone this epiphysis (usually the last to fuse) has already joined the rest of the bone, only the faintest traces of its epiphyseal line remaining. By contrast the epiphysis for the ischial tuberosity and the conjoint rami is still ununited, the epiphyseal line being here quite distinct.

Pathological

(1) *Osteo-arthritis.*—" Rheumatic " change, chiefly spinal and costo-vertebral, is present in three of the skeletons (Nos. 1, 2, and 5). In the male No. 1 there is generalized severe osteo-arthritis of the vertebral column—involving both the bodies and the neural arches—and a correspondingly severe affection of the costo-vertebral joints. Spinal and costal mobility was seriously diminished and possibly considerable pain was suffered. A very destructive arthritis of both temporo-mandibular joints has profoundly distorted the glenoid fossæ and the mandibular condyles, and has had a marked effect upon mastication.

The old woman (No. 2) manifests senile osteo-porotic changes in the backbone, with superadded atrophy and " rheumatic " lipping of the lumbar vertebræ. The lumbo-sacral spine is severely crippled, the pathological change stopping just short of actual vertebral ankylosis. Pain was doubtless a symptom in this case also.

Specimen No. 5 (middle-aged woman) also suffered somewhat from generalized spinal " rheumatism ". The pathological changes are more pronounced in the cervical spine and in the thoraco-lumbar region; the lowest four costo-vertebral articulations are also involved in an arthritis, though the remainder are healthy and functional. The neural arches have escaped destructive change, save in the neck, where they are extremely distorted, and where they have involved certain of the posterior rami of the spinal nerves, presumably giving rise to chronic deep-seated pain.

(2) *Traumatic.*—Individual No. 7 suffered, in childhood, a crippling injury (? penetrating wound) of the left elbow-joint, in consequence of which the left arm remained permanently acutely flexed at the elbow-joint throughout life; flexion and

extension were possible through a few degrees only, though pronation and supination were probably preserved in fair degree. The skeletal atrophy consequent upon such a stabilization of the arm is strikingly apparent in the subnormal development of the left clavicle, scapula, humerus, radius, and ulna, when compared with the corresponding bones of the opposite, sound, limb.

Odontological.—The Lanhill skeletons, representing members of one Neolithic family group, are of extreme odontological interest.

Of seven skulls present, four manifest either dental disease or irregularity, thus disproving current and erroneous conceptions of the invariability of a perfect dentition in early or " primitive " peoples.

Parodontal disease occurs in skulls Nos. 1 and 2, supernumerary teeth and cusps appear in skull No. 3, whilst No. 7 manifests maleruption of the upper 3rd molars.

Skulls Showing Evidence of Parodontal Disease

Skull No. 1 (adult male) : The right maxillary central incisor has been lost long before death, and its socket is fairly well healed ; both maxillary 3rd molars have been lost from parodontal disease at some later period, with defective healing of their alveoli. The whole of the maxillary alveolar border forward to, and including, the canines evidences a long-standing and severe pyorrhœa ; the roots of the remaining teeth are largely exposed, especially the molar roots upon their lingual aspect. Apical abscesses have burst through to the surface above the right first molar and the left premolars. Crown attrition is pronounced everywhere, but particularly in connexion with the left maxillary premolars, which are reduced to mere stumps almost half their normal size, with extremely oblique occlusal surfaces. The mandible, at death, retained the incisors, the canines, the right 1st premolar, the left premolars (all severely crown-worn) and possibly the left 3rd molar, whose socket exhibits extensive bony disease ; the left moiety of the mandibular body has undergone considerable absorption following tooth loss. The right alveolar margin from the first premolar backwards is edentulous and distorted by parodontal disease ; the unhealed sockets for the second premolar and second molar are some index of the order of tooth loss as well as of the severe degree of parodontal disease responsible therefor.

Both temporo-mandibular joints manifest a pronounced chronic osteo-arthritis, probably connected with the dental conditions present. The right mandibular condyle is flattened, eburnated, and mushroomed, though the corresponding glenoid fossa remains little changed. The left condyle is almost completely absorbed down to the level of the mandibular neck ; its articular surface is distorted by pitting, and the corresponding glenoid fossa is grossly distorted by the complete absorption of the anterior root of the zygoma. These destructive joint changes are in part at least the consequence of the alteration of the bite, itself modified by the ravages of severe parodontal disease (*see* fig. 1).

Skull No. 2 (senile female) : The maxillæ were almost completely edentulous at the time of death, the right canine and (?) premolars alone remaining in situ. Backwards from the canine area the alveolar margins reveal an extreme degree of destruction and an unhealed condition of the tooth-sockets. The normal atrophy of senility is likewise present, and its pronounced degree on the left is shown in fig. 2, *a*. The mandible (fig. 2, *c*) retained at death the left canine and second premolar ; the socket for the left 3rd molar is open and unhealed. The entire extent of the mandibular alveolar rim reveals evidence of a severe and chronic infective process which, in the region of the right mental foramen, has involved the inferior dental canal, giving rise presumably to a septic neuritis of the mandibular nerve. The temporo-mandibular joints are healthy.

FIG. 1*a*.

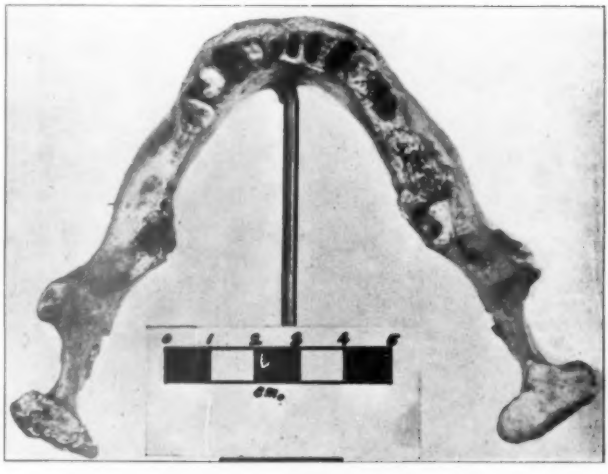

FIG. 1*b*.

FIG 1, *a*, *b*.—Lanhill Skull No. 1. Loss of teeth and bony changes indicating parodontal disease: osteo-arthritis of temporo-mandibular joints.

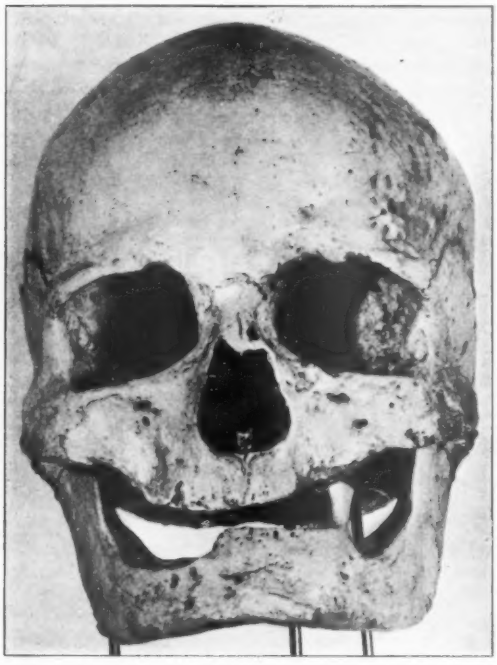

FIG. 2*a*.

FIG. 2*b*.

FIG. 2, *a*, *b*, *c*.—Lanhill Skull No. 2. Showing evidence of parodontal disease and the extreme left maxillary absorption.

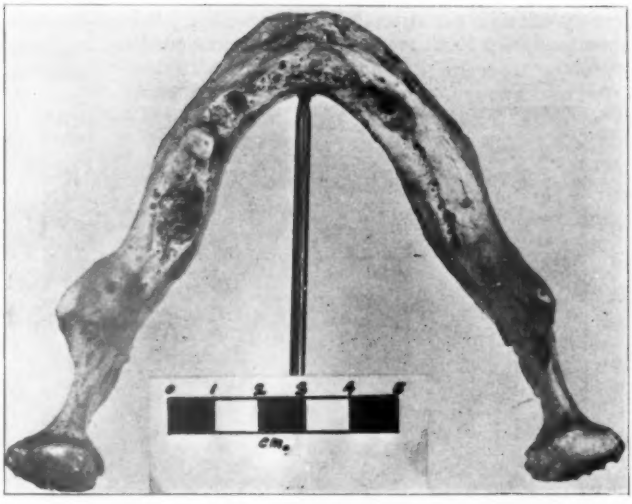

FIG. 2c.

Skulls Showing Dental Anomalies

Skull No. 3 (adult male) : A full complement of healthy maxillary and mandibular teeth was present at death. The alveoli are well formed and completely free from any sign of disease. Crown attrition is present, and considerable, but the pulp cavities are nowhere opened into. The maxillary molars are disposed obliquely, and the third member of the series presents a small adventitious posterior cusp. On the right

FIG. 3a.

Lanhill Skull No 2. Showing supernumerary 4th molar in situ.

a supernumerary 4th molar is imbedded in the maxillary tuberosity, and on the left, two such supernumerary teeth are enclosed in a corresponding, but bipartite, cavity (*see* fig. 3, *a*, *b*).

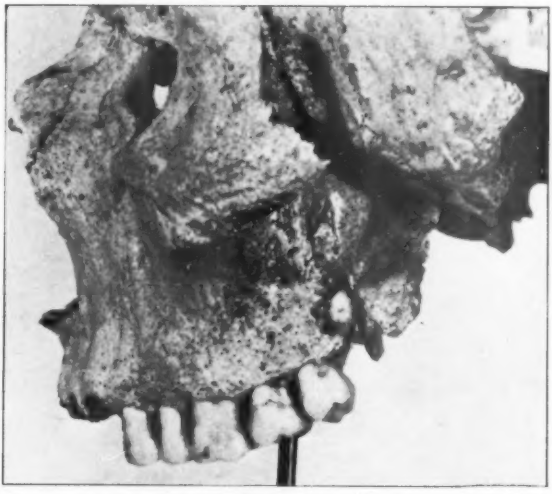

FIG. 3*b*.

FIG. 3, *a*, *b*.—Lanhill Skull No. 3. Showing one of the two supernumerary left molars in situ.

FIG. 4*a*.

Lanhill Skull No. 7. Showing malocclusion of the maxillary 3rd molars.

These supernumerary teeth are small but fairly well formed; their eruption would probably never have taken place.

The mandibular 3rd molar bears a small posterior adventitious cusp; otherwise the mandible and its contained teeth require no further comments.

Skull No. 7 (adult male): At death, all the teeth, save the right maxillary lateral incisor, were retained, as healthy structures in equally healthy alveoli. The maxillary 3rd molars, however, are malocclude (fig. 4, *a*). They have erupted successfully,

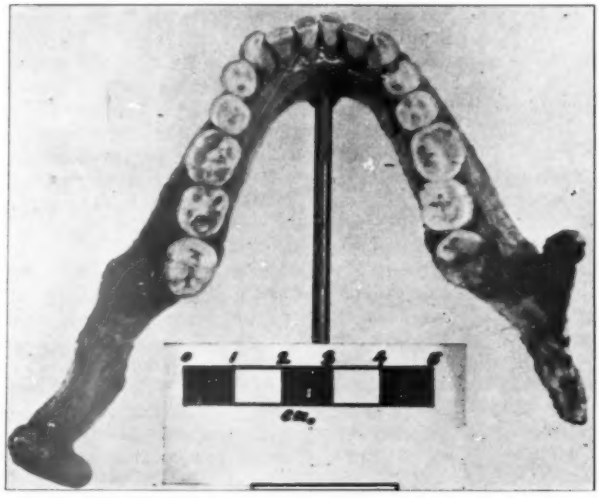

FIG. 4*b*

FIG. 4, *a*, *b*.—Lanhill Skull No. 7. Showing slight crowding of anterior mandibular teeth.

but face backwards from the maxillary tuberosity at the level of the roots of their respective anterior neighbours. The unopposed mandibular 3rd molars, unworn, project markedly above the level of the remaining molar crowns. Crown attrition is extremely pronounced in all teeth save the 3rd molars; it has led to cusp-ablation and to complete destruction of much of the enamel of the molars and incisors. There is some slight degree of overcrowding of the anterior mandibular teeth fig. 4, *b*).

Section of Obstetrics and Gynæcology

President—MILES PHILLIPS, M.D.

[*June* 17, 1938]

DISCUSSION ON OBSTETRIC SHOCK

Dame Louise McIlroy: There is no very definite information available as to the exact nature of obstetric shock. Primary shock is in most cases associated with hæmorrhage, but delayed shock, although rare without the previous presence of primary shock, occurs in some cases within a few hours of delivery, and when no cause is known or suspected. Surgical shock and obstetric shock are closely allied, and the Great War provided considerable information as to the results of traumatism and bruising of tissues in war wounds (Cannon: "Traumatic Shock", New York, Appleton, 1923). The President has stressed the great importance of the prevention and treatment of obstetric shock (*Brit. Med. Journ.*, 1931 (i), 833).

Shock as a factor in the causation of maternal mortality possibly has more serious influences than we imagine, since statistics classifying deaths due to hæmorrhage rarely give shock as a separate factor. In the Royal Free Hospital, out of 9,468 cases with a maternal mortality of 26 cases (2·7 per 1,000) six of the deaths were due to shock and four to shock and hæmorrhage combined (*Lancet*, 1930 (i), 97). Doris Brown considers that shock is one of the most serious accidents of childbirth, resulting in a high maternal mortality, 16·3% of all deaths ("Obstetric shock", *Ulster Med. Journ.*, 1937, p. 293). The mortality rate is not comparable with the incidence rate as undoubtedly a considerable number of patients recover under efficient treatment.

NATURE OF SHOCK

There are various theories as to the nature of the condition. These comprise disturbances of the vasomotor and heat-regulating centres caused by the production of toxic substances from bruised or lacerated tissues, histamine being given as an example. These substances enter the blood-stream and cause a rapid fall of the systolic blood-pressure, with stagnation of the corpuscles in the dilated capillaries, leading to plasma depletion of the vital organs and tissue œdema. Acidosis is present when the carbon dioxide content of the blood is lowered. Bailey and Driscoll ("Shock in pregnant and puerperal women", *Am. Journ. Obst. and Gyn.*, 1926, **11**, 287), maintain that owing to the exertion of labour the respiratory centres become depleted of carbon dioxide, and that collapse occurs from respiratory, not from cardiac, failure. The importance of the influence of the suprarenals upon blood-pressure has also to be considered in relation to shock.

Shock differs from hæmorrhage in that the surface capillaries are not depleted of blood; the skin is grey or cyanosed and is cold and damp from sweat. The temperature is low, the respirations are shallow, and the pulse-rate, as a rule, is high. The patient is dull and apathetic, in contrast to the patient who is collapsed owing to hæmorrhage, there is anxiety, restlessness, and air hunger. In a case of shock the systolic blood-pressure may fall below 80 mm. and sometimes cannot be recorded.

Primary shock usually follows hæmorrhage or extensive injury of the birth-canal. It may be the result of rapid evacuation of the contents of the uterus, as in the case of sudden rupture of the membranes in hydramnios. Rapid emptying of a distended bladder may cause signs of mild shock, such as shivering.

Secondary shock may occur when we think a case of primary shock is on the

way to recovery. The onset may be sudden, and death may occur within a few minutes. Delayed shock is not always associated with primary shock or hæmorrhage. It may mean that there is infection or peritonitis. It may occur within a few hours of an apparently normal delivery.

Causation of Shock

Shock following rupture or acute inversion of the uterus is well known, but the chief interest lies in the more frequently occurring type of case such as after a protracted labour, with consequent muscular fatigue, or when lacerations have occurred as the result of precipitate labour or hurried instrumental intervention. The President has laid great emphasis upon lacerations of the pelvic floor as a cause of shock.

The predisposing causes of shock are preventable in many cases by efficient supervision of the patient during pregnancy. A patient who is anæmic or under-nourished naturally has a low resistance to strain, injury, or even a moderate loss of blood. In pulmonary or cardiac diseases there is a likelihood of the occurrence of shock after delivery.

The study of the mental attitude of the patient during pregnancy and labour is of the utmost importance. Mental anxiety and suffering react upon the tissues and lower resistance to shock and infections. The present-day Press publicity of maternal mortality statistics causes fear among child-bearing women. When a patient dreads a confinement or a major operation the risk is intensified and the medical attendant is always anxious as to the result. In cases of illegitimate births the element of shock is sometimes encountered if there has been much mental anxiety.

The next most important causes of shock are toxæmia and chronic nephritis. Poisons added to those already in the circulation cause over-stimulation of the medullary centres and general lowering of vitality. Acidosis may also be present. Hypertension in toxæmia may be a natural effort to combat these poisons. When the fall in blood-pressure is rapid there is serious shock. We know little of these conditions, and they are worthy of much investigation and research. Eclamptic patients and those suffering from chronic nephritis stand operations badly and statistics show a high mortality in these cases, after *accouchement forcé*. Collapse and death may follow the rapid evacuation of the uterus and fall of intra-abdominal pressure. Conservative methods of treatment have now superseded operative measures in a large number of cases.

Shock, apart from that due to hæmorrhage, seldom occurs during pregnancy. Patients with low blood-pressure and shock should be treated for shock, and a rise in blood-pressure established, before any operative interference is carried out. In cases of placenta prævia the hæmorrhage must be controlled by methods which cause least bruising of tissues. Forcible dilatation of the cervix in the treatment of hæmorrhage is sometimes followed by severe shock. When the hæmorrhage ceases these patients usually respond quickly to restorative treatment.

Causes of shock during labour and delivery.—Laceration of the pelvic tissues frequently followed forcible dilatation of the cervix by *accouchement forcé*—a method of delivery now happily relegated to the past. The application of forceps when the cervix is partially dilated, or when the fœtal head is above the brim, may be the cause of shock. It is not the duration of labour that matters, but the degree of suffering and strain. Sedatives such as morphine, chloral, &c., should be given during the first stage.

Excessive muscular exertion such as undue straining, causes fatigue and is responsible for a tired, relaxed uterus after delivery. Toxins are driven into the blood-stream and the carbon dioxide content of the blood is lowered. Exposure to cold and wet bed-clothes lowers the vitality, and undue sweating, due to muscular exertion and heat, helps to deplete the body of fluids. Excessive purgation causes loss of body fluids.

The choice of an anæsthetic is important. Nitrous oxide with oxygen is the safest; chloroform, except when given in small doses and when the administration is not prolonged, may give rise to acidosis and toxic liver changes. Ether is less dangerous.

Mismanagement of the third stage of labour is in my opinion the most frequent cause of shock, apart from that due to hæmorrhage and operative measures. Some persons have little patience, and do not hesitate to remove the placenta by the hand if there is any delay in its delivery. This operation is one of the most serious in obstetric practice, and should be avoided unless there is urgent reason for its performance such as hæmorrhage. I feel convinced that an adherent placenta is of rare occurrence.

As soon as the delivery of the infant has taken place, a hand placed on the uterus may feel if the placenta has descended into the vagina. No massage is necessary, except in cases of hæmorrhage, and should then be applied very gently. When the placenta has descended and the uterus is contracted, the placenta may be expelled by hand if the patient cannot expel it herself. When it protrudes at the vulva, the hand should at once be taken off the abdomen, as the stimulation of the uterus may cause snapping-off of the membranes following the delivery of the placenta. If there is post-partum hæmorrhage and the uterus fails to contract under massage, bi-manual compression of the body of the uterus will stop the loss of blood.

Prophylaxis and Treatment

Efficient antenatal supervision by a qualified medical practitioner is essential. Deficiency diseases, such as anæmia, toxæmia, &c., should be prevented by suitable diet, fresh air, and exercise.

All fear should be banished. Sleeplessness should be treated by suitable sedatives. If there is toxic antepartum hæmorrhage, the patient must be treated for toxæmia and shock before any operative measures are contemplated. Blood-pressure observations will be the guide as to her progress. Morphine is useful in these cases, and sulphate-of-magnesia solution introduced into the colon is of benefit. Glucose in fruit-juice solution should be given to drink. Cæsarean section is a dangerous operation in cases of collapse. Even packing the vagina may increase the degree of shock. In 40 consecutive cases of toxic antepartum hæmorrhage under my care, I did not perform one Cæsarean section and there were no deaths. The method of treatment was to treat the toxæmia and rupture the membranes. In cases of placenta prævia, as already mentioned, hæmorrhage should be controlled at once by the easiest method possible, as, for example, by Willett's clamp.

Throughout all labours, patients, when awake, should be fed and have fluids such as glucose lemonade given to them. Starvation is responsible for much of the undue fatigue and collapse after delivery. Sedatives, e.g. morphine, chloral, and bromide, should be given in the first stage of labour, and gas-and-oxygen during the second stage. Slow delivery by forceps is advisable. Mr. Phillips advocates the leaving of the perineum unstitched until collapse, if present, has been treated.

Administration of fluids.—If the blood-pressure is low it can only be raised by the administration of fluids, and it is absolutely necessary that this should be carried out at once by the best means at hand—by mouth, with glucose drinks if possible, and by rectum with saline or coffee saline solutions, which may be given through a rubber tube and funnel or by a douche can.

Slow subcutaneous injection of saline solution into the tissue under the breasts, or into the axilla or the thigh is a method available in most cases. The administration to be effective should be slow and the temperature of the fluid just above body heat.

In hospital practice the procedure is easier than in domestic practice and administration into the vein is much to be preferred to any other method, short of

blood transfusion. Sterile flasks of fluid are now supplied by chemists and are ready for use after being heated in warm water.

Saline solution acts quickly but its effect is only temporary; the fluid soon leaves the vessels and diffuses into the tissues; the addition of 6% solution of gum arabic causes longer retention. Dextrose, 20%, is sometimes added.

Blood transfusion is the ideal method of restoring a collapsed patient, but in emergency cases it is difficult to find a donor, except in large hospital centres, and the grouping is impossible unless methods for doing it are easily available. In domestic practice, especially in places at some distance from a town, the flask of saline gum-solution is the most useful, because it can be kept at hand. The slower the method of administration of fluid or blood, the better. The continuous-drip method is that most frequently employed, except in cases of extreme urgency, e.g. after severe hæmorrhage, when fluid must be administered as quickly as possible. The blood-pressure should be ascertained at frequent intervals; by this means the patient's progress can be observed. Oxygen is of use combined with 5% carbon dioxide. Warmth should be applied with care; Wright and Colebrook (*Lancet*, 1918 (i), 763) have pointed out the danger of too-rapid raising of the temperature by increasing acid in the blood. Collapsed patients should not be removed to hospital until treatment for shock has been carried out. The "flying squad" arrangement is excellent, as it does not involve the removal of the patient. Stimulants have their place, but it is useless to whip-up a flagging heart until the loss of fluid has been restored. Pituitrin is advocated, but I have seen the occurrence of shock after the administration of a pituitrin injection.

Dr. H. L. Sheehan: At the Glasgow Royal Maternity Hospital during the last five years, a study has been made of all patients who died with the clinical appearances of shock during delivery, or within twenty-four hours afterwards, and who were examined post mortem. Some ætiological factor was present in every case; no examples were found of "pure obstetric shock", i.e. shock following a normal delivery in a healthy woman, without any clinical or pathological explanation. This is probably dependent on the rejection of all cases in which a post-mortem examination had not been made.

The pathological changes were not in agreement with those described in experimental shock. The chief findings were: (1) Subendocardial hæmorrhages in the left interventricular septum. These were usually present when the patient had remained a few hours in a state of shock before death; they were not found when the patient had died rapidly. They occurred in certain other patients who had died without apparent shock, and the possibility of a cerebral or vagal disturbance must be considered in these cases. The hæmorrhages were considered to be probably indicative of a circulatory disturbance in this region which may have had a deleterious effect on cardiac function.

(2) The lungs sometimes showed some congestion and œdema of one or two lobes, particularly in cases in which shock had followed a series of hæmorrhages, or in cases of shock without hæmorrhage in which the patient had died during delivery or within an hour or two afterwards. Intravenous glucose-saline did not lead to œdema of the lungs in any of the cases studied. Sometimes there were multiple small petechial hæmorrhages throughout the lungs, but the significance of these was not clear.

(3) The anterior pituitary gland showed necrosis in many of those patients who lived long enough for the histological changes to become recognizable. This was apparently a result of the general circulatory collapse. In the initial stages, before the necrosis was sufficiently advanced to be recognized under the microscope, there was presumably a serious functional disturbance of the anterior lobe. No decision could be arrived at as to whether this functional disturbance might be a factor in the deaths of shocked patients, a few hours after delivery. The enormous mortality

from post-operative collapse among rats hypophysectomized at the time of delivery was, however, an interesting finding.

(4) Acute dilatation of the stomach was a common finding—particularly after dystocia shock—and was presumably a result of a vagus disturbance.

(5) The pressure lesions at the base of the bladder were sometimes the source of a very early pyelonephritis, which might cause pyrexia and raised blood urea.

(6) The uterus sometimes showed gross lesions, such as rupture of the lower segment, utero-placental apoplexy, or inversion. In dystocia-shock the uterus was large, œdematous, and poorly-retracted in the early stages; certain of the late shock deaths were associated with gross œdema and early necrosis of the myometrium. In cases of retained placenta the patients who died early showed little or no abnormality of the uterus, but in the cases of later shock deaths the uterus was large and œdematous, while in one case of very late death it was in the condition of early necrosis.

(7) In the pelvic floor there was sometimes hæmorrhage between the bladder and symphysis in the dystocia-shock cases, but no other obvious hæmorrhage was seen except in ruptured uterus. The œdema of parametria and pelvic floor which occurred in certain of the cases was insufficient to account for shock on a plasma-loss theory.

(8) The ovaries showed extensive hæmorrhage in the stroma in a few cases; probably this was not due to trauma.

(9) The other viscera and the general vascular system showed no changes of significance.

Dr. W. H. F. Oxley said that he agreed with most of the points raised by Dame Louise McIlroy and with her methods of treatment, but when he had heard her speak about a special kind of shock, labelled " obstetric shock ", occurring in normal women after a normal labour, he felt as if he had been transported to an unknown world. Although he had been responsible for some 50,000 confinement cases he had never seen such a condition. In this he agreed with Dr. Herbert Spencer, and it had been interesting to learn from Dr. Sheehan that death from this cause had not occurred in his hospital.

Traumatic shock was not uncommon after severe injuries of the genital tract, and some women died from it—as they died from shock after injury to other parts of the body. Shock also occurred in cases of hæmorrhage, even though the amount lost was insufficient to affect the blood volume to a serious extent. He had seen nervous girls faint during labour, but the fainting was due to syncope, not to shock. In some girls fainting occurred from very slight causes.

No doubt physiologists would say that there could be no pain without shock and they were probably correct, but in normal labour cases the shock was so slight that it could not be discovered on ordinary clinical examination and the mothers did not feel ill. He suggested that the label of " obstetric shock " was being wrongly affixed to the common conditions of fatigue and starvation after prolonged labours, and since these could be avoided by timely intervention and good feeding it was dangerous to introduce that new idea. In his hospital women were fed frequently during labour, having soup, puddings, sweet drinks, &c.,—not solid meals, because an anæsthetic might be needed, but plenty of nourishment. A woman needed food if she had to work, whether the work was a day's washing or having a baby, but she did not always get it.

In reply to a question by the President: Binders were used at his (the speaker's) hospital, but were not applied until the patient was ready to be warded—about half, or three-quarters, of an hour after the child was born. Their use could not account for the absence of " obstetric shock " said to be due to the sudden diminution of intra-abdominal pressure at the birth of the child and therefore necessitating the application of the binder immediately afterwards.

He thought that a hand placed on the abdomen gave a better idea of the state of the uterus during the third stage of labour than mere observation did.

He did not advise the stitching of perineal tears before the birth of the placenta : in fact, he thought that in the event of serious tears better anatomical approximation of the tissues could be obtained if an hour or two were allowed to elapse before the repair was carried out, and he adopted this practice whenever it was convenient.

He had no hesitation in removing the placenta manually, for he knew that if his experienced labour-ward nurses were unable to squeeze it out it was adherent and not merely retained. Under those circumstances there was no object in waiting.

Dame Louise McIlroy (in reply) said that it was her custom to repair the perineum while waiting for the separation of the placenta. The hæmatoma described by Dr. Sheehan might possibly be due to the heavy hand-manipulation of the uterus during the third stage. When performing Cæsarean section she manipulated the uterus as little as possible because of the danger of hæmatoma of the broad ligament. She did not describe the bandaging of the extremities as this was so well known in the treatment of cases of hæmorrhage. In her opinion manual expulsion of the placenta from the uterus was inadvisable except in cases of hæmorrhage.

Large Mesenteric Cyst situated mainly behind the Cæcum and resembling an Ovarian Cyst-Adenoma

By S. Gordon Luker, F.C.O.G.

Mrs. R., aged 36, was seen by me at the Out-patients' Department on March 31, 1938. She had had five children (the last being 9 years old), and had had no miscarriages. She was complaining of a pain in the right iliac fossa seven days previously. There had been some faintness but no vomiting ; the bowels had been open regularly.

Present condition.—The periods had been regular every twenty-one days, and lasting for four days, the last having taken place two weeks previously. She said that the loss had not been much lately. Her general health was good.

On abdominal examination, a median swelling was felt rising above the pubis and to the right side. It was ovoid in shape and reached from the pelvic inlet below to above the level of the umbilicus towards the right loin. It was tense and elastic and (?) cystic. The uterine body was felt to be distinct. There was no history of any difficulty in micturition or of any increase or decrease in the quantity of urine. The diagnosis gave rise to some doubt because the tumour was not entirely mobile and could not be pushed away from the right iliac fossa. Hydronephrosis was suspected but there had been no symptoms connected with the urinary system. The patient was admitted to hospital where, on further examination of the urinary system, hydronephrosis was excluded. A tentative diagnosis of an ovarian cyst in the originating right broad ligament was made.

Operation.—On April 8, under spinal anæsthesia, a left paramedian incision was made and a large cyst, 7 in. in diameter, was found in the cæcal region, quite distinct from the right tube and ovary. It had the appearance of a smooth-walled, ovarian cyst, with a wall thick enough to give it a pearly lustre. It was situated in the lower part of the mesentery of the cæcum and ascending colon, and was quite distinct and separate from the uterus or its appendages, from which it was distant 3 in. The cæcum and appendix were pushed forward by the tumour so as to be situated on its anterior aspect near the middle. The intestine was empty and there was no evidence of obstruction to the passage of the intestinal contents. The peritoneum was incised over the antero-lateral surface of the tumour and the cyst was then carefully shelled out of its bed. There were two bundles of vessels supplying blood to the cyst, but

these were not large. After enucleating the cyst, the hole in the mesentery was closed by a continuous suture.

On being opened the cyst was found to contain a glycerine-like fluid stained slightly brown; when this was boiled a precipitate was obtained, but no precipitate was formed by the addition of acetic acid.

The patient made an uninterrupted recovery.

Microscopic report (Dr. W. McNaughtan): The appearances were those of a papillary cyst-adenoma of the ovary—apparently non-malignant, although epithelial hyperplasia in some areas gave the impression that it could not be far removed from malignancy.

The microscopic section was referred to the Pathological Committee of the Section, who reported as follows:—

> "The epithelial lining consists of columnar cells sometimes in a single layer, but for the most part in papillary formation with loose cellular stroma. There is some colloid secretion and much luxuriant overgrowth of epithelium, but no change in the architecture of the cells. From the histological picture it is impossible to say whether or not this growth is malignant." (*See* figs. 1 and 2.)

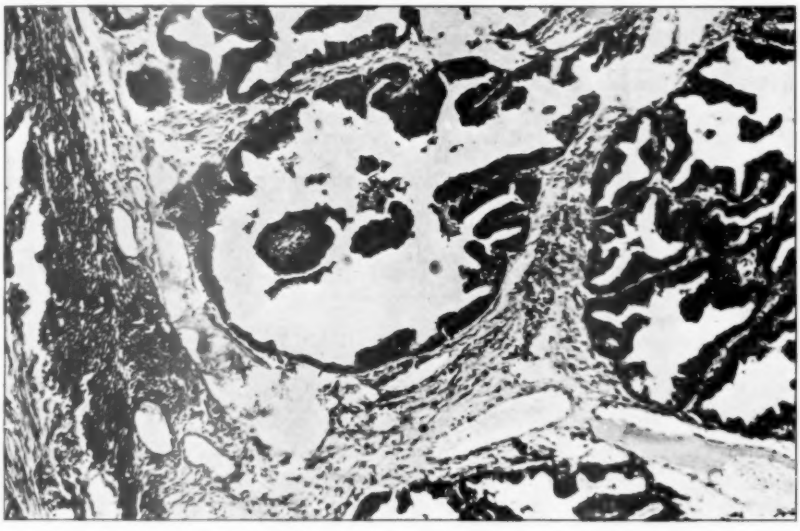

FIG. 1.—Section of the cyst wall, under low power.

The origin of the cyst must, I think, be from Wölffian relics. In view of its position, I do not think it probable that it is derived from an accessory ovary.

Mesenteric cysts are very rare tumours of the abdomen, and I have had no previous experience of a cyst of this nature nor can I find any reference to one in the literature. The definition is reserved for tumours which are situated between the two layers of the mesentery.

From a study of the literature, it appears that in many of the recorded cases the cyst was very small and was discovered by chance, rather than because of any symptoms to which it gave rise.

Warfield (*Annals of Surgery*, 1932, **96**, No. 3) claimed to have collected 129 cases from the literature since the year 1920. Of these, 71 were in females and 37 in males.

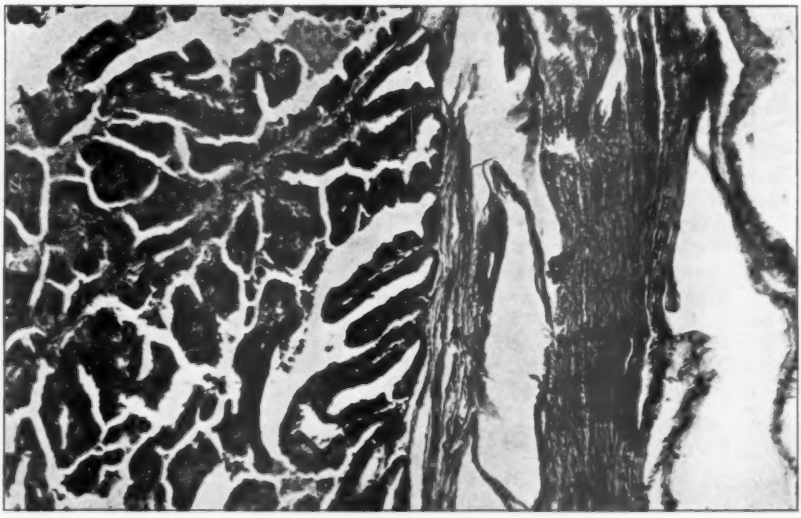

FIG. 2.—Another section of the cyst wall under low power.

The largest age-incidence was between the thirtieth and fortieth years. The neoplasms were classified according to their origin, which was generally embryonic or from mesodermal remnants, intestinal diverticula, or the vitelline duct. The structure of the cyst wall varied with the origin of the tumour. In one-third of the cases the cysts were complicated by intestinal obstruction. The author does not give pathological details as to the cyst wall in the two cases upon which he had operated, both of which occurred in males.

Flynn (*American Journal of Surgery*, N.S., 1933, 22, 322) gives an account of a case in which the diagnosis of ovarian cyst was made. The tumour proved to be a cyst in the mesentery of the ileum, containing about a pint of fluid. Examination of the wall showed necrotic tissue but did not show anything to indicate the origin of the tumour.

Roller (*Surgery, Gynecology and Obstetrics*, 1935, 60, 1128) reported three cases out of a series of 900 admissions to his clinic. In one of these the cyst was very small and caused no definite symptoms. In each of the others the patient was a male, the case had not been diagnosed, and the cyst was found to be in the mesentery of the ileum.

The ætiology and classification of these tumours appears to be as follows :—

(1) Embryocystomata from Wölffian relics.
(2) Cystic dermoids and teratomata.
(3) Enterocystomata (fœtal intestinal diverticula).
(4) Chylous cysts.

The symptoms are not noticeable until growth or enlargement in the abdomen shows itself. They are attributable to complications such as intestinal volvulus (40%), intussusception, obstruction, attachment to organs, rupture into bowel, adhesions, infection, and hæmorrhage.

The treatment is by one of the three following methods: (1) Enucleation; (2) enucleation with resection of bowel; (3) incision and drainage.

Section of Radiology

President—R. E. ROBERTS, M.D.

[*March* 18, 1938]

DISCUSSION ON SKELETAL CHANGES IN METABOLIC AND ENDOCRINE DISORDERS

Professor Henry Cohen: There are few problems in medicine which have been more clearly illuminated in the darkness of the X-ray room than that of abnormalities of the growth and development of the skeleton. The radiological appearances of diseased and deformed bone have been described with a wealth of detail, and many attempts at their classification have been made. "Disease labels" have rapidly accumulated and we have too often rested content with the label instead of probing the disturbed mechanisms which underlie these bony changes. The fault is not, however, entirely attributable to the clinician and radiologist. Until recent years physiology lagged behind clinical observation in the group of bone diseases which we are about to discuss. Indeed it might justifiably be claimed that in few other fields of medicine has clinical observation so successfully stimulated physiological research.

I would in the first place, for reasons both of expediency in presentation and of the time allotted to me, limit the meaning of the term "metabolic". It is true that in one sense all processes concerned with the nutrition of tissues—the circulation, neurotrophic influences, poisons circulating in the blood-stream, &c.—modify tissue metabolism, but by common consent, when we discuss disorders of metabolism, we limit the term to those diseases which result from abnormalities, quantitative and qualitative, in the supply and utilization of food-stuffs. I intend, moreover, to limit my remarks to *bony* skeletal changes, and to avoid obscuring the general problem with a complete though inconsequential list of all the bone changes which have been described in metabolic and endocrine disorders. My purpose is rather to restate our present knowledge of the principles underlying bone growth and metabolism, and whilst fully recognizing its many gaps I shall endeavour to correlate it with bone changes occurring in disease.

I propose, therefore, to discuss the problem under three headings :—

(1) Disorders of *bodily growth and development*, of which skeletal changes are a part.

(2) Disturbances of *bone metabolism* itself.

(3) Diseases in which the bones play a passive part in the disease process, i.e. they are simply the *repositories* of foci of disease.

DEVELOPMENT OF BONE

Let me first recall the essential facts concerning the histogenesis of bone laid down in cartilage. The first evidence of differentiation is a condensation of mesenchymal cells. The central cells elongate at right angles to the mass of cells and become separated by an intercellular substance—the cartilaginous matrix.

This early cartilaginous mass, destined to form the diaphysis and its plates, is elliptical in shape, with its convexities directed towards the future epiphyses. The central diaphyseal cells increase in both size and number; they then shrink and an increasingly dense cartilaginous matrix forms. Thus the primitive shaft is a rod of cartilage actively proliferating at its ends—the diaphyseal plates. The mesenchyme immediately surrounding the primitive cartilaginous shaft becomes differentiated to form the perichondrium, which consists of an external layer of fibroblasts and an internal layer of cells, which gives rise not only to blood-forming elements and blood-vessels but also to osteoblasts, forming the periosteum. Ossification begins round the cartilaginous shaft as a sheaf of lamellæ composed of fibrils in which bone salts soon appear. These lamellæ form a hollow cylinder of compact bone and, amongst them, the bone corpuscles (originally osteoclasts) are occluded. Blood-vessels develop and carry osteoblasts to the cartilage enclosed by this primitive bony sheath; later, osteoclasts appear. As the blood-vessels of the marrow spread to the ends of the diaphysis the cartilaginous shaft is eroded into channels, but at the bone ends a characteristic arrangement of cartilage cells is maintained—a diaphyseal zone of hypertrophic cells adjacent to the blood-vessels of the shaft, an intermediate layer of round cells and a layer of flattened cells contiguous with the epiphysis, which has developed in similar fashion to the diaphysis but has received a separate blood supply by invasion of blood-vessels from its external surface. Thus it is that proliferation of cartilage occurs at the junction of diaphysis and epiphysis and this must continue satisfactorily if *normal* growth is to be assured. Ossification is preceded by calcification but the relative intensity of osteoblastic (bone-forming) and osteoclastic (bone-resorption) activity varies, at one time the former, at another the latter, predominating. The periosteum acts not only as a bone-forming tissue but as a limiting membrane normally shaping the shaft of the bone. Thus normal bony growth demands:—

(1) normal cartilage proliferation, in both extent and duration, at the growing metaphysis, and

(2) its normal calcification;

(3) a proper balance between formative and resorptive processes in the bone, and

(4) maintenance of the periosteum as a true limiting membrane.

It is possible from a more detailed consideration of these processes, to assign many of the disorders which we are about to discuss to their appropriate categories.

Factors Influencing Growth and Development

Gardiner-Hill, in his Oliver-Sharpey lectures for 1937, has reviewed this aspect of the problem in detail, and his monograph repays careful study. We know that growth cannot be represented by a uniform, uninterrupted curve. There are periods of faster and slower growth. The former or "springing-up" periods are three—during the first year of life, the period of the second dentition (5 to 7 years), and puberty. At these times, skeletal growth is rapid; in the intervals there is "filling-out" by muscular and visceral growth. In infants the limbs are short compared with the trunk; in the second "springing-up" period the limbs begin to lengthen at a more rapid rate than the trunk. I have already stressed, in considering the development of bone, that the site of longitudinal growth is at the diaphyseal ends.

Our knowledge of the factors influencing the growth of the body is limited. The very phrasing and use of such terms as "inherent power to grow" and "genetic constitution" to explain certain aspects of growth is a measure of our ignorance. The influence of three factors—(*a*) endocrine glands, (*b*) vitamins, and (*c*) diet—is, however, well established.

Endocrine influences.—Of the endocrine influences, that exercised by the *anterior*

lobe of the pituitary gland is most profound. Both experimental and clinical evidence support the view that a growth hormone is elaborated by this portion of the gland—probably by the eosinophil cells—which exerts its effect on growth not only directly but also through the mediation of the thyroid, adrenals, and gonads, which are under its influence. This hormone stimulates the growth of cartilage as it does that of other tissues. Its excess tends to hasten growth, its deficiency to retard growth. Its effect in different species varies. A marked acromegalic response follows its administration to such dogs as the sheep-dog or dachshund; rats and rabbits show but little change under its influence. How far the thyroid acts independently of its stimulation by the pituitary growth hormone is difficult to assess, but it is a general metabolic stimulant and there is experimental evidence to show that it stimulates growth temporarily, and in the tadpole induces premature metamorphosis. Recent work on the thymus suggests that it, too, may play a part in influencing growth and development, for in rats its continuous administration has resulted in the offspring of the injected animals showing in the third and succeeding generations marked, though temporary, acceleration of growth.

The gonads, by regulating maturity, control also the time of fusion of the epiphyses. Both the adrenals and the pineal play a part in this process by their influence on sexual development.

Vitamins.—Since vitamins A, B, C, and D are necessary for normal growth, the deprivation of any one of them will retard both growth and development. But two have a specific effect in relation to bone growth. The absence of vitamin C leads to scurvy and its associated capillary hæmorrhages. In infants these hæmorrhages are specially prone to involve the diaphyseal capillary loops; thus the calcifying cartilage and new bone may be destroyed. Vitamin D has a specific effect on the calcification of cartilage though, as we shall see, it is but one of the factors concerned in this complicated process.

Diet.—Although vitamins may be regarded as one of the dietetic factors influencing growth, their action is so different from that of food-stuffs of the protein ("tissue-building"), fat and carbohydrate ("energy-providing") groups, that the latter are indicated when we speak of *dietetic* factors. It is clear that the diet must provide not only adequate calories but also the amino-acids which are essential proteins containing those for tissue growth.

Harris's lines.—It is important to recall that the growth cartilages are extremely susceptible to general diseases which interfere with nutrition, e.g. starvation and acute infections, and Harris has demonstrated transverse lines of arrested growth in the long bones of children who have suffered from severe illness. These correspond to similar transverse lines of arrested growth seen not only in the teeth but also in the nails. Indeed on the nails transverse furrows at regular intervals, indicating impaired growth, have often afforded the clue to the diagnosis of such undulant fevers as the Pel-Ebstein syndrome in lymphadenoma, and *Brucella abortus* infections.

Abnormal Bodily Growth in Endocrine Disturbances

We are now in a position to classify the skeletal abnormalities that result from those disturbances of endocrine balance which influence general body growth. Three groups can be recognized: (1) Gigantism. (2) Precocious Maturity. (3) Dwarfism and Infantilism.

(1) *Giants* result in the main from two pathological disturbances: (*a*) pituitary eosinophilism, which produces (i) true gigantism before the epiphyses fuse with the diaphysis, and (ii) acromegaly if it occurs after this fusion has taken place; and (*b*) deficient gonadal secretion (eunuchoidal giant), which prolongs adolescence and thus delays the closure of the epiphyses so that overgrowth of the long bones results.

Hypogonadal giants rarely attain the height of the hyperpituitary giant. It is possible that over-feeding and excessive vitamin administration, may lead to increased growth, but of this we have no direct evidence.

(2) In *precocious maturity* (macrosomia præcox) we find both somatic and genital precocity. But the disturbance is one not of the " size " but of the " time " factor. Indeed, far from being giants, these patients, if they survive, are often dwarfs, for the fusion of diaphysis and epiphyses is premature and ossification centres have appeared early.

Any tumour which produces excess of the sex hormone may induce the changes of precocious maturity. Granulosa-cell tumours of the ovary produce true precocious puberty in the female, whilst interstitial-cell tumours of the testis (though but few cases are recorded) produce true precocious puberty in the male. Tumours of the pineal gland are occasionally associated in the male with precocious maturity, but evidence is accumulating that this is unlikely to be the result of a specific secretion of the pineal gland but is due to a destructive lesion in the wall of the 3rd ventricle, for not only inflammatory lesions but also astrocytomas involving this area have given rise to similar precocity. Tumours of the adrenal cortex and ovarian arrhenoblastomas often induce masculinity in the female, with bone development much advanced for the patient's age, and premature epiphyseal fusion. In these cases the resulting syndrome is not a " macrosomia præcox ", or true precocious puberty, but a " masculinization " of the female, and it is interesting to note that when adrenal cortical tumours occur in the male infant, though there may be overgrowth with premature appearance of pubic hair and other secondary sex characteristics and external genitals may enlarge, the testes remain immature and show no spermatogenesis.

(3) Of the *endocrine dwarfs* the types recognized are :—

(*a*) The *hypopituitary* or Lorain-Levi type, in which deficiency of the growth hormone occurring before the second dentition leads to persistence of the infantile type of skeleton; if the deficiency develops later the skeleton is of rather more mature type though the limb-trunk ratio remains disproportionate. There is delay in both ossification and fusion of epiphyses.

(*b*) The *hypothyroid*—cretin and infantile myxœdema—with delayed ossification, union of epiphyses, and occasionally a curious osteochondritis of hip and phalanges.

(*c*) The *hypogonadal*—though here, as we have seen above, gigantism may result.

Other causes of dwarfism.—Besides skeletal diseases, either developmental (e.g. achondroplasia, osteogenesis imperfecta, &c.) or acquired (e.g. spinal caries), which result in defective stature, it must be stressed that not only endocrine deficiency but true nutritional disturbances may retard growth. Those associated with specific metabolic disturbances at the growth cartilages, e.g. rickets, cœliac rickets, renal dwarfism, &c., will be considered later. But we know that undernutrition, for example, in the diabetic child; vitamin A and B deficiencies; the vascular disturbances of vitamin C deficiency; infections at the bone ends such as syphilitic osteochondritis; Addison's disease in childhood; congenital heart disease; &c., may produce dwarfism which can be easily differentiated, however, on clinical and radiological grounds from that of endocrinous origin.

Specific Bone Metabolism

Thus far we have concerned ourselves solely with the effect of the endocrine glands and metabolism on the body growth in general and noted the resulting changes in the skeletal structures. But bone has a metabolism peculiar to itself. It is a living structure which depends for its specific nutrition on an adequate supply of calcium, phosphorus, magnesium, and other inorganic ions. This supply is conveyed

to bone by the blood (10 mgm. of calcium and 4 mgm. of phosphate per 100 c.c.) and variations in the normal plasma content of calcium, phosphorus, magnesium, &c., can disturb bone metabolism. How complicated are the factors controlling the plasma content of these ions is seen by a consideration of calcium alone. Its concentration in the plasma is dependent on at least five factors: (1) Adequate calcium intake; calcium is absorbed from the gut largely as soluble phosphates and the optimal absorption is attained where the proportion of calcium to phosphorus in the diet is in the relation of 3 to 5; excess of either element leads to the formation of insoluble compounds which are excreted in the fæces. (2) The acidity of the intestinal contents; (3) vitamin D (or ultra-violet radiation). Both these factors aid the absorption of calcium. (4) The amounts of phosphorus and magnesium present in the plasma. (5) The parathyroid hormone; this most important factor, when present in excess, raises the calcium content of the plasma and lowers the phosphorus content, unlike vitamin D which, when in excess, raises both phosphorus and calcium content of the plasma.

This is not the place to discuss the mechanism of parathyroid activity, but it is not so simple as in earlier days it was thought to be. Evidence is accumulating that in some instances an excess of phosphate may be the factor which excites the parathyroids to over-activity, and that in these cases the hypercalcæmia is a secondary effect of hyperphosphatæmia through the compensatory mediation of the parathyroids.

The factors discussed above regulate the calcium of the plasma. Let us consider the factors which determine whether calcium will be deposited in bone or resorbed from it. Of these, five are recognized: (1) The hydrogen-ion concentration and carbon dioxide tension of the plasma. (2) The presence of substances influencing the solubility of calcium phosphate, e.g. proteins, magnesium, &c. (3) The presence of phosphatase and possibly related enzymes; their mode of action is as yet imperfectly understood but they play a major part in the deposition of calcium phosphate in bone. (4) Vitamin D which, in addition to aiding the absorption of calcium from the gut, exerts a specific control over its deposition in bone. (5) The parathyroid hormone which, in excess, mobilizes the calcium of bone with resulting osteoporosis.

It is interesting to note how, in the problems relating specifically to bone, both endocrine and metabolic factors are closely interwoven, and even how in their clinical manifestations, as for example in renal rickets, it is not easy to dissociate their respective influences.

There are two disorders of specific bone metabolism which demand special attention:—

(1) Generalized fibrocystic disease of bone (osteitis fibrosa cystica; hyperparathyroidism), and

(2) The "rachitic syndrome."

Osteitis fibrosa cystica needs but little discussion. Its classical manifestations—(1) generalized osteoporosis with late spontaneous fractures; (2) cysts and giant-celled tumours (osteoclastoma); (3) metastatic calcification especially in the kidneys and blood-vessels—are familiar to us all. In most cases a parathyroid adenoma has been found associated with the disease; in others, parathyroid hyperplasia; in a few there is no recorded change in the parathyroids, though failure to find this may have resulted from inadequate search. The calcium of the blood is raised, the phosphate lowered; the serum phosphatase is high. The calcium output in fæces and urine is in excess of the calcium intake in the food; the excess calcium excretion is largely in the urine unless there is marked renal impairment.

What is the *modus operandi* in fibrocystic disease? Does a parathyroid adenoma arise *de novo* and, by increasing the circulating hormone, draw calcium from the bones

with resulting osteoporosis, hypercalcæmia, &c. ? Or does some primary disturbance of phosphate metabolism, e.g. a hyperphosphatæmia, induce parathyroid hyperplasia as a compensatory mechanism, so that more calcium flows into the blood to form with the excess of phosphate in the plasma, an inactive and excretable calcium phosphate ? Helfet's observations on giving patients suffering from this disease alum salts by mouth so as to prevent excess phosphate absorption from the gut suggests that in some cases the latter may be the offending mechanism, but the true adenomatous parathyroid found in most recorded cases lends support to the former interpretation, and the complete restoration to normal of calcium deposition in bone when the parathyroid tumour is removed, would be difficult to explain on any other view.

The "Rachitic Syndrome"

Rather than particularize different types of disease to which the term "rickets" has been applied, I suggest that for the purposes of this discussion the term "rachitic syndrome" be substituted, for in all the types a deficiency of vitamin D, with a variable disturbance of calcium and phosphate metabolism, may be present. Usually the plasma phosphate is diminished and the calcium normal, or slightly reduced ; in other cases the calcium is low and the phosphate normal or slightly elevated. In all the anatomical change visible radiologically is one of failure of calcification of the growth cartilages and freshly formed bone. The bones are thus soft, malleable, and poorly calcified ; the line of ossification is irregular and imperfect ; the diaphyseal ends are thickened and broad. These changes are noted in : (1) vitamin-D deficiency ; (2) steatorrhœas. (3) renal rickets.

Vitamin-D deficiency.—This includes (*a*) rickets in infancy and early childhood ; (*b*) late adolescent rickets ; and (*c*) osteomalacia, the adult counterpart of rickets, occurring after osteochondral growth is completed : it is subdivided into types—(i) pregnancy and lactation, (ii) hunger, (iii) senile—to specify the exciting ætiological factors, which suggest that osteomalacia may result from an excessive call for vitamin D, or its defective supply or utilization.

Steatorrhœas.—The fatty stools of cœliac disease and pancreatic deficiencies result in defective absorption of vitamin D and the necessary salts for calcification.

Renal rickets presents a similar radiological picture but a different biochemical problem. In some cases, chronic nephritis is the primary lesion ; the resulting phosphate retention leads to hypocalcæmia, acidosis, &c., with bone decalcification and defective cartilage calcification ; in these a secondary parathyroid hyperplasia is often found. In other cases a primary hyperparathyroidism with hypercalcæmia is alleged, the resulting excessive calcium excretion leading to the sclerotic renal changes. The clinical picture is similar in both types.

Decalcification.—In general then, decalcification of bone can result from one or more of five factors :—

(1) Imperfect balance of calcium and phosphorus in blood, e.g. low calcium with high phosphorus ; low phosphorus with high calcium ; or low calcium and low phosphorus.

(2) Vitamin-D deficiency.

(3) Hyperparathyroidism.

(4) Prolonged immobility of bones, e.g. from splinting, and in arthritis.

(5) Plasma excess of magnesium and strontium salts ; and of phosphates.

Metastatic Deposits

This heterogeneous group of bone changes in endocrine and metabolic disorders is added for the sake of completeness. The bone changes are, as far as we know,

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PLATE I.

FIG. 1.—Left knee region.

FIG. 2.—Left leg and foot.

FIG. 3.—Right knee region.

FIG. 4.—Right leg and foot.

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PLATE II.

R. L.

FIG. 5.—Both feet.

L. R.

FIG. 6.—Both upper limbs.

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PLATE III.

FIG. 7.—Left upper limb.

FIG. 8.—Dorsal spine (antero-posterior).

FIG. 9.—Dorsal spine (lateral).

PLATE IV.

FIG. 10.—Pelvis.

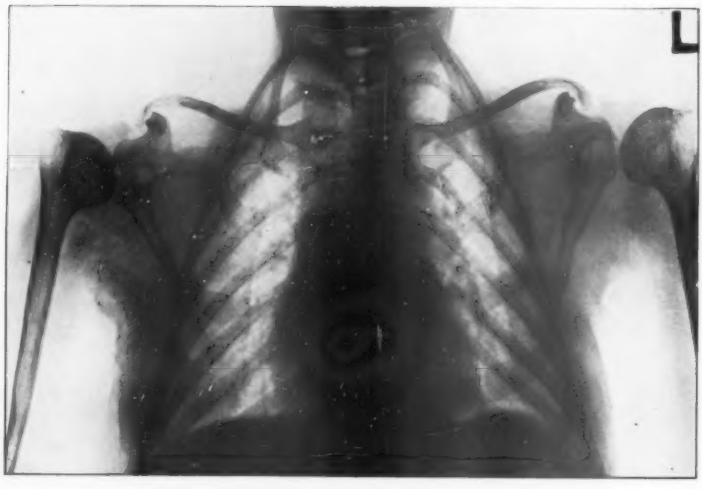

FIG. 11.—Chest.

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largely incidental and unrelated to specific bone growth or metabolism. We observe these metastatic deposits in—

(1) Metabolic diseases, e.g. gouty tophi in bone; the lipoid deposits in Hand-Christian's, Gaucher's, and other lipoidoses; the arthritic changes of oöchronosis and hæmatoporphyrinuria, &c.

(2) Malignant growths of endocrine glands, e.g. of the thyroid and suprarenal, in which bony metastases are not uncommon,

The association of multiple myelomatosis with Bence-Jones proteinuria deserves mention, though it is unlikely to have a primary metabolic basis.

Unsolved Problems

Many problems—and amongst them some of the most immediate practical importance, for example, the ætiology of osteitis deformans—remain unsolved. Mystery surrounds the pathogenesis of osteogenesis imperfecta (fragilitas ossium) and its associated blue sclerotics. Is Albers-Schönberg's or marble-bone disease its contrasting state? Why does osteoporosis occur in pituitary basophilism? Is it a local or general disturbance which so often associates obesity with hyperostosis interna frontalis? Are achondroplasia, chondro-osteodystrophy, Ollier's disease, and diaphysial aclasis all graded manifestations of a similar process in which the limiting functions of the periosteum in growth and expansion of bone are impaired? If so, what factors disturb this function? Can the periosteum evince as life advances excessive resorptive function and thus explain the following case, unique so far as I can ascertain?

Case Record

E.H., female, aged 44 (R.I. 62175). First seen 21.9.37.

History.—Walked at 2 years, and remained quite normal until the age of 5. Then frequently fell and the right knee became "bent and difficult to straighten". There was gradually increasing difficulty in walking until, at the age of 11, "hopping about on her knees" was the only mode of progression. At the age of 6, changes in the upper limbs were first noticed, with gradual flexion of the proximal interphalangeal joints. Then slowly the bones of the hands seemed to melt away, leaving the soft structures unaltered. Similar changes gradually occurred in the feet and she has noted that on the average it takes four or five years for any phalanx to undergo the change above described. With fixation of the joints, pain is severe, but as the bone is gradually re-absorbed and the parts become softened, the pain disappears.

On examination.—A brief summary of the skeletal features is as follows:

Total length from vertex to toes, 41 ins.; length from sternal notch to symphysis pubis 15¼ ins. Skull of average adult size; maximum circumference 21¾ ins. Maximum length of hands (not stretched) 3½ ins.; length of feet each 5 ins. Length of arm (acromio-clavicular joint to tip of prominence of lower end of humerus) right 9½ ins.; left 11 ins. Measurement of forearms, each 5 in. Average length of fingers 1¾ ins.; and they can be stretched out to 2¼ ins. Spine: Marked lumbar lordosis and slight scoliosis; excessive range of movement, particularly extension. Excessive range of movements at all joints, particularly elbows and shoulders, which can be rotated almost through 360°. The knees are an exception; they exhibit a flexion deformity of about 70°; flexion is full, but extension is limited to 70° (normal 180°).

Length of thigh (anterior superior spine to lower end of femur), right, 19 ins.; left, 19 ins. Length of leg (lower end of femur to external malleolus), right, 14 ins.; left, 13 ins.

The maximum deformity is of the hands and feet, which are shortened, there being very little palm to the hand or sole to the foot. The hands and feet have a peculiar feel; in only a few places can structures resembling bone be felt. The soft tissues,

particularly of the hands and feet, appear redundant and are very wrinkled. The fingers can be pulled out at least half an inch, and when tension is removed they automatically telescope back into position. There is no bowing of long bones or evidence of old fractures. The patient can sit up; dress, feed herself, and even crochet, mainly with the aid of the right index finger, which is the one least affected.

There was no evidence of disease in other systems and all investigations on calcium balance, gastric analysis, &c., proved negative. The radiograms, by Dr. R. E. Roberts, reveal changes in the bone suggestive of excessive periosteal absorption.

Conclusion

These are but a few of the problems that remain to be solved. Any attempt at correlation and classification of the disorders we have been discussing must remain incomplete and tentative whilst our present ignorance persists. In bone disease, as indeed in all disease, knowledge of normal physiological mechanisms is essential to the proper understanding of the phenomena of disease. Advance will come from careful clinical observation, controlled experiment, and guarded interpretation. It will not follow the wildly speculative abandon of so many endocrinologists for whom the phrase " endocrine imbalance " is the solution to all problems of pathogenesis. Nor must we replace our compelling curiosity to understand the mechanism and chemistry of bone changes in disease by a seductively simple hypothesis, such as is exemplified by the ingenuous faith of those who are content to interpret all alterations in the bony skeleton in terms of its blood supply.

Dr. M. H. Jupe: In endocrine disease the bone changes which can be recognized by X-rays, may be grouped as follows :—

(1) Disturbance of the calcium content.

(2) Disturbance of growth and ossification.

(3) In a few instances, effects of pressure from an enlarged gland, bone deposits due to secondary neoplasm, and cyst-like areas due to osteoclastomata in cases of hyperparathyroidism.

Disturbance of the calcium content is a common phenomenon and is recognized by lack or increase of density in the bone shadow. When there is a lack of calcium the whole bone is softened and tends to bend as a result of the body-weight or the thrust of the bones at certain points such as that of the femoral heads into the pelvis, or as the result of the pull of strong muscles. When excess of calcium is present it does not mean that the bone is sclerosed or hardened. Actually, the bone may be more brittle. This is well illustrated by the fractures seen in the case of amorphous osteitis deformans and Albers-Schönberg's disease. It is most important, therefore, when dealing with suspected endocrine or deficiency disease, to use " control " radiograms, so that some comparison with the normal can be made. At the London Hospital we use, if possible, a patient of the same sex, age, and weight, and both patients are radiographed on the same film at the same time. There are other methods in use, possibly more scientific, but to my mind less convincing, especially for teaching students. In Holland a wedge of bone has been used and this is radiographed with the patient on the same film. In America and Canada a series of steps made of aluminium is included in the picture. There are many other methods. It is certain that some " control " must be used if radiology is to supply any great help in these cases.

In children the trabeculæ of the bone are small and easily obscured, so that the earliest sign of lack of calcium is a general haziness of the bone pattern. As the disturbance proceeds the pattern disappears entirely and the bone gives the " ground-glass " appearance described in scurvy. In the adult the fine trabeculæ disappear

first and leave the coarse striæ, and this gives the appearance of accentuation of the bone pattern. As a result of this marked osteoporosis of uneven density, the condition may be mistaken for carcinomatosis.

In patients suffering from several of the endocrine diseases there is a tendency to obesity and this always gives the impression that osteoporosis or lack of calcium is present. Our knowledge of basophilism is too small to allow of dogma. In this condition osteoporosis certainly occurs, but further proof that it is more marked in the bones of the trunk than of the limbs is needed ; it is possible that this impression has arisen as the result of the X-ray filtering effect of the body fat in these cases. The fat in cases of basophilism is almost confined to the face and trunk—sites where " control " radiograms are not easily made—and there is not much fat on the limbs. At post-mortem examination it is not usual to remove and examine the distal bones of the limbs and so our knowledge is limited in this direction. Patterson has proved the presence of osteoporosis in the skull in basophilism. I think it is reasonable to assume that the osteoporosis is general throughout the whole skeleton and not confined to the trunk.

Disturbances of growth and ossification are chiefly concerned with pituitary abnormalities. It is at present impossible to say if the other glands—the adrenals and gonads—are involved primarily or only secondarily to the pituitary. It seems reasonable to say that the tallness of the subject is dependent on the pituitary entirely, but it is not unreasonable to suppose that the pituitary may stimulate in the gonads a substance which produces the secondary sex characteristics and also may bring about union of the epiphysis with the shaft in the long bones and so cause cessation of growth. By lack of this stimulation the union of the epiphyses may be delayed and growth may continue ; this is what takes place in the eunuchoid giants.

To classify the changes brought about by each gland separately is impossible at present, for it is probable that all glands are interdependent ; any classification must depend on the more obvious clinical facts and tends to be one of convenience.

Thyroid

Hyperthyroidism.—Golden and Abbott quote that Köpper, in 1892, described a case of hyperthyroidism, in which von Recklinghausen performed an autopsy and reported the presence of osteomalacia.

In 1931, Stettner reported lack of calcium in the bones of a child who had had long-continued administration of thyroid extract. Osteoporosis is now a well-recognized feature of severe hyperthyroidism. It is not a constant fea ure and, though more likely to occur in severe cases, is not necessarily inevitable.

The osteoporosis may be very patchy, and so give the appearance of carcinomatosis. One sees such cases in which the radiological evidence without the knowledge of any clinical history or signs might have been very misleading. Partial thyroidectomy may lead to improvement in the appearance of the bone, but it does not necessarily follow that it returns to normal density.

Hyperparathyroidism.—A great deal has been said and written on this subject and in view of the short time at our disposal I do not propose to give it very much consideration. Radiologically one feature must be stressed above all others and that is the presence of osteoporosis. The presence of generalized osteoporosis and the positive chemical evidence are enough to warrant a diagnosis of hyperparathyroidism. In addition, cyst-like areas, fractures and bending of the bones may be seen. Calcium deposits may be found in the kidneys. A search should always be made for the parathyroid tumour ; this may be situated in the neck or actually in the thorax. Several observers have demonstrated such intrathoracic tumours radiographically. Finally, " control " radiographs should be taken after operation, for if the bones do

not begin to return to their normal density after some weeks, a second parathyroid tumour may be indicated and further exploration may be necessary.

Myxœdema.—Cases of increased density in the bones have been reported as associated with myxœdema, but personally I have not seen any definite change in any case I have examined.

Cretinism.—The skeletal changes of endemic cretinism such as is seen in the mountainous districts in Switzerland, are more marked and varied than the sporadic cases which are met with in this country. The endemic cretin is goitrous. Professor Schinz kindly sent me prints of some of his cases. There is marked delay in epiphyseal growth and union, and the epiphyses, especially the femoral heads, are liable to be deformed and fragmented. Coxa vara is common. The metacarpals and metatarsals are short and thick. The sella turcica may be enlarged. The vertebral bodies may be squat and narrow. Occasionally these changes are seen in the sporadic cretin but usually the child has been given thyroid extract for some time before the radiologist sees the case. Through the kind help of Dr. Maitland-Jones I have been able to collect a few untreated cretins, and all except two proved uninteresting. The bones were possibly a little short and thick and Wormian bones were seen in the skull; otherwise nothing obviously abnormal was seen. In the two cases of interest, both of which occurred in very young children, there was a zone of extra density at the ends of the shaft of the long bones (fig. 1), very marked in one case and only slight in the other. There was no history or symptom to suggest any metal poisoning and the appearance was not that of osteopetrosis. The condition disappeared after the administration of thyroid extract (fig. 2). If hyperthyroidism can produce osteoporosis it would seem reasonable to expect hypothyroidism to produce increased density, and in the infant this would probably be most marked in the growing ends of the bone. The bone which was formed *in utero*, would be subject to the secretions circulating in the maternal blood, and it would be only after birth, when these maternal secretions were cut off, that the deficiency made itself felt. Ross Golden states that "A circle of increased density around the carpal centres of ossification, and thickening of the zones of preparatory calcification, were occasionally noted", but he makes no mention of increased density in other bones.

Pituitary

Eosinophilic over-activity of the anterior lobe. If this occurs before the union of the epiphyses, gigantism results with acromegalic changes. If the union has taken place pure acromegaly results. The features are very well known. They consist of enlargement of the bones of the hands and feet with tufting of the terminal phalanges, and accentuation of the muscle attachments. In the skull the pituitary fossa is enlarged in most cases, though it may be unaltered. The accessory air spaces of the skull are enlarged. The whole skull is thickened. The mandible increases in size and becomes prognathous and the teeth become separated as a result. In the trunk kyphosis of the spine occurs and the antero-posterior diameter of the chest is increased.

Another type of gigantism is the eunuchoid giant. At a meeting of the Section of Medicine in 1937, Dr. A. C. Crooke showed the two cases which I am now showing:

I.—Patient, male, aged 30, suffered from fits. Height 6 ft. 2 ins.; has grown 1 in. since he was aged 23. Weight 15½ stones. No secondary sex characters. Voice unbroken. External genitalia undeveloped. *Radiographs:* The union of the epiphyses is incomplete. Compared with normal control there is some osteoporosis. The sella turcica is certainly not enlarged, in fact the vertical diameter is below the average.

II.—Patient is a woman aged 41, suffering from rheumatic pains. Height 5 ft. 10 ins. Weight 16¼ stones. Secondary sex characteristics poorly developed. Infantile uterus; has

PLATE I.

FIG. 1.—Band of increased density at the lower end of the tibia and fibula in a cretin.

FIG. 2.—Same child as fig. 1, two and a half years later, after administration of thyroid extract. Showing total absence of any sign of band of increased density.

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FIG. 3*a*.—Skull showing erosion of dorsum sellæ and calcified shadow in the region of the 3rd ventricle.

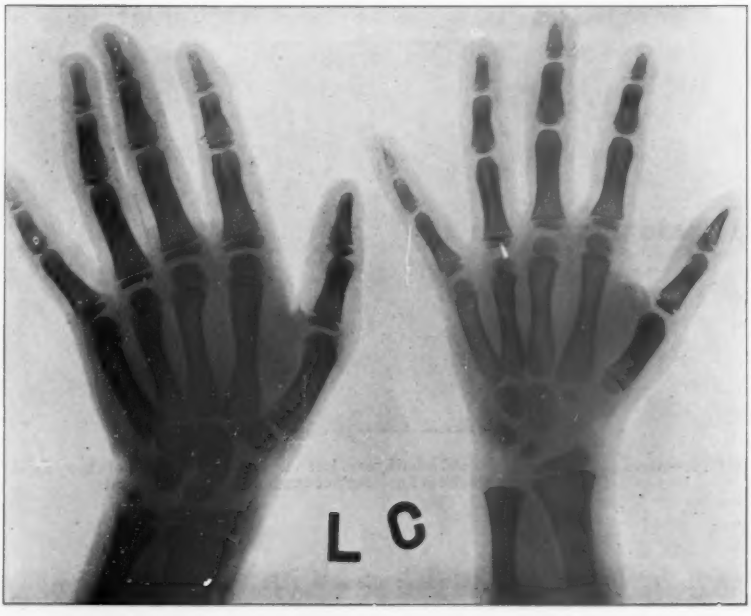

FIG. 3*b*.—Patient's hand and wrist taken with that of "control".

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PLATE III.

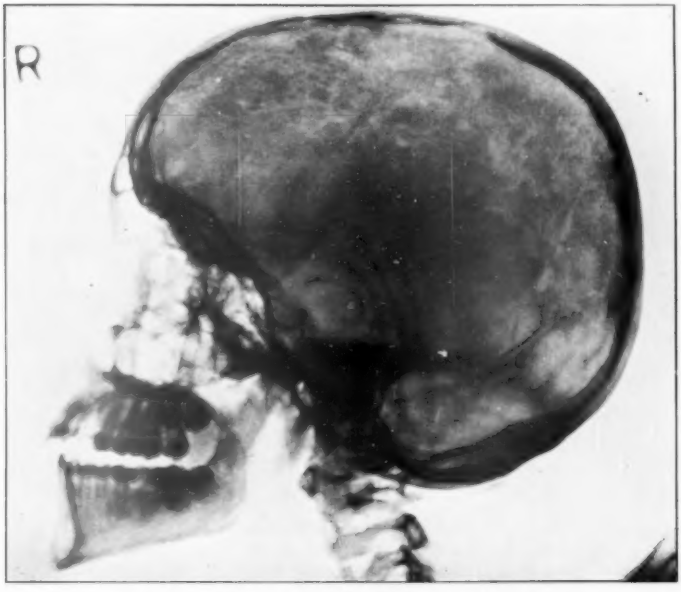

FIG. 4.—Suprasellar calcification in a girl aged 15 years.

FIG. 5.—Hand of same patient as fig. 4, showing the union of all the epiphyses.

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never menstruated. *Radiographs*: Lines of union of epiphyses still well seen. The union of the epiphyses of the iliac crests is incomplete. The sella turcica is normal.

It is to be assumed that the growth has continued because the closure of the epiphyses is delayed. Crooke points out that evidence is accumulating that gonadotrophic hormone exerts some influence on the closure of the epiphyses, and that when pituitary dwarfs are treated with growth hormone, there is a great spurt in the rate of growth and this ends shortly, owing to closure of the epiphysis. This is believed to be due to contamination of the growth hormone by gonadotrophic hormone.

The chromophobe adenoma will enlarge the sella turcica, but has no secretory effects.

The subject of basophilism is complicated. The name is used to describe a syndrome, the cause of which is not definitely known. The condition is more common in females; it is characterized by amenorrhœa in the female and impotence in the male, and adiposity confined to the face, neck, and trunk. Hypertrichosis, with hair of male distribution, is seen in the female. The blood-pressure is raised and the patient plethoric. Radiologically the bones in the later stages show osteoporosis, and fractures may occur. It is unusual to find any enlargement of the pituitary fossa though it does occur.

It is difficult to decide where the cause of this syndrome lies. Identical features are certainly seen with tumours of the suprarenal cortex and with carcinoma of the thymus. Cases have been reported in which symptoms of basophilism disappeared after the removal of a suprarenal tumour. Leyton, Turnbull, and Bratton reported two cases of basophilism associated with a carcinoma of the thymus. Crooke, in his valuable work on this subject, has demonstrated that a hyaline change is found in the basophil cells of the pituitary body in all cases of basophilism, whether a tumour of the pituitary, suprarenal, or thymus, is present or not.

Suprasellar cyst (craniopharyngioma) may cause changes in the size of the sella turcica with or without calcification above the fossa. The subjects of this malady are usually children and young adults, and although there is usually some slight degree of mental precocity it is rarely that sexual precocity is seen. Development is usually retarded and the date of appearance and rate of growth of the epiphyses may be delayed.

Tumours about the sella turcica usually cause under-development in all structures if they cause any change at all, but may occasionally be responsible for pubertas præcox. Lhermitte, de Martel, and others, reported such a case in 1931. In England, Le Marquand and Russell gave a very full and accurate account of a boy aged 2½ with marked sexual precocity and abnormal development of the bones and epiphyses. This child died at the age of 4 years and 10 months, and at autopsy there was found to be a mass in the interpeduncular space attached to the tuber cinereum and right corpus mammillaria. More recently Professor Hugh Cairns sent a boy aged 6 years, suffering from precocity, for radiography of the epiphyses and skull. The genital development is that of a youth of 18. There is acne of the chin and back. The boy is tall but is mentally dull. He is not sexually difficult. Radiographs show the epiphyseal development to be much advanced (fig. 3*b*). In the skull the dorsum sellæ is eroded from above downwards, and above the sella a definite area of calcification can be seen (fig. 3*a*). This indicates the presence of a tumour—probably a glioma—situated in the region of the floor of the 3rd ventricle. There is no doubt that this is a case of precocity due to a tumour in the hypothalamic region.

It must be supposed that the Lorain dwarf is the result of pituitary insufficiency, though in many cases there is no radiological evidence of pituitary abnormality. These dwarfs are the "Peter Pans" of medicine and appear to remain children throughout life. At the age of 45 they may have the form and size of a

child, have ununited epiphyses and unerupted teeth. I have seen one case in which a tumour above the sella turcica was diagnosed. The evidence was based on a fleck of calcification above the sella (fig. 4), slight enlargement of the pituitary fossa, and visual changes. The child was 15 years old and was small in stature, but obese. She had never menstruated. All the epiphyses which were examined radiologically were found to have united, except the epiphysis of the iliac crest (fig. 5). The deciding factor in the dwarfism is obviously the closure of the epiphyses, and this is probably the direct result of hyperactivity of the gonads arising secondary to the lesion in the region of the pituitary gland.

Suprarenals

Apart from basophilism associated with carcinoma of the suprarenal cortex, the only suprarenal tumour which may be of interest to the radiologist is neuroblastoma of the medulla. In addition to causing areas of erosion in the bones themselves, the growth lays down sheaths under the periosteum of the long bones, especially the femora. This gives a picture of symmetrically raised periosteum which, in conjunction with an abdominal tumour, and possibly exophthalmos, may be diagnostic.

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Dr. G. B. Batten showed lantern slides of two cases of combined osteosclerosis and osteoporosis occurring in brothers, aged respectively $6\frac{1}{2}$ and $5\frac{1}{4}$. Both boys were blind and the elder had marked glycosuria; the heads of both were markedly larger than the normal for their ages. In both, all the long bones, including the ribs, showed the same peculiarities—sclerosis of the cortex mainly in the middle of the shaft, and marked widening and porosis of the ends; the epiphyses were also porous, and had a "stippled" appearance. There was also sclerosis on both sides of the frontal bone. The clinical appearances, except for the large heads and the blindness, were almost normal, but there was macular atrophy of the skin of the abdomen.

Dr. Batten said that Dr. R. W. B. Ellis had shown these cases at a meeting of the Section for the Study of Disease in Children, in 1934 (see *Proceedings*, 1934, **27**, 1563, (Sect. Dis. in Child., 67), as cases of marble bones or Albers-Schönberg's disease, and supported the theory that the condition was due to hyperparathyroidism. He, the speaker, however, after seeing the skiagrams from two cases of marble bones, considered these to be cases of atypical osteogenesis imperfecta, because in marble-bone disease the shafts of the long bones were much less dense than the ends—which, with the epiphyses, were usually very dense indeed—a condition exactly the opposite of that in these two boys. Dr. Donald Paterson said that the condition of their blood and general metabolism was the same as it was in 1934.

The radiological appearances, certainly, had not altered in character. One peculiarity was that in each of the two cases the metacarpal and metatarsal bones showed epiphyses at both ends.

Probably marble-bone disease and osteogenesis imperfecta, as shown in these cases, though apparently opposite in appearance, were both due to imperfect development connected with endocrine disorders. These cases seemed to be very rare.

Dr. J. E. A. Lynham showed a series of slides illustrating the bone changes seen in a case of generalized osteitis fibrosa cystica. A parathyroid tumour had been successfully removed by Mr. Lawrence Abel, after excision of a cyst from the tibia which showed typical changes. Subsequently the patient's blood-calcium had reverted to normal, and within a few months the bones had returned to practically normal density.

Dr. Gilbert Bush showed slides of two cases of hyperostosis of the inner table of the skull, in which the condition was more diffuse than in the more commonly known "hyperostosis frontalis interna". Morel, Sherwood Moore, and Carr, stated that it was almost entirely confined to the female sex, was found after the age of 40 usually, and was associated with obesity of the face and trunk, mental changes, headache and attacks of vertigo, migraine, &c. Hirsutism also was a common feature. In general hospitals the incidence was only about 0·014%, whereas in neurological clinics Morel found it to be one hundred times as frequent. While some cerebral atrophy often occurred and the condition was slowly progressive, the bone changes were considered by Carr to be associated changes and not primarily responsible for the mental symptoms. Both metabolic and endocrine disturbances were present but the mechanism was still obscure. In one of the cases of which the slides were shown the hyperostosis was of a very diffuse type involving the frontal and both parietal bones, and there was extensive calcification of the falx cerebri.

Dr. S. Cochrane Shanks: I am showing two cases as follows :—

I.—*Osteo-malacia.* E. W., female, admitted to Charing Cross Hospital in 1934, then aged 14 and unable to walk. The radiogram of the pelvis showed gross osteoporosis, the bones being merely a pencilled outline. There was marked trefoil deformity and gross scoliosis.

Blood-calcium 9·86 mgm. %; blood phosphate 4·10 mgm. %.

Stools.—Total fat 14·4%
Neutral fat 11·25% } of the total.
Split fat 3·1%

(i.e. no excess of split fat in the stool, which might have carried away the calcium.)

The calcium balance over a nine-day period, on a diet of 100 mgm. calcium and 223 mgm. phosphate a day, showed an average calcium excretion of 96 mgm. and phosphorus excretion of 334 mgm. This grossly excessive phosphatic loss appeared to be the cause of the condition.

The alkali reserve was 48 vols. %, and the blood phosphatase 0·21 units. The blood Wassermann reaction was negative.

The patient was in hospital for nineteen months, during which time she was treated with radiostoleum and calcium gluconate, intravenously and by mouth.

She was discharged, fit to walk, when the blood-calcium was 9·9%. A second radiogram, in April 1937, showed considerable increase in the calcification of the bones.

To compare with this I am showing my second case :—

II.—*Fragilitas Ossium.* M. M., a girl aged 5, attended Charing Cross Hospital as an out-patient in January 1937. She was born with a fractured femur, and when 3 years old

fractured the same bone again. When five years old she fractured the right femur. No bones other than the femora were fractured.

This child has the typical blue sclerotics, and, as would be expected, her blood-calcium and phosphorus are normal.

Her family history is interesting, since about 15 members are similarly affected—all of them females—and the femur is the bone mostly affected; the patient's mother fractured her femur fourteen times.

The radiograms show the feebly ossified pelvis and "fish" vertebræ, an appearance which is not exclusive to fragilitas ossium, but develops in other types of decalcified bones in young children.

Section of Laryngology and Section of Otology

JOINT MEETING IN ASSOCIATION WITH THE SCOTTISH SOCIETY OF OTOLARYNGOLOGY

HELD IN GLASGOW, JUNE 10 AND 11, 1938

LARYNGOLOGICAL SESSION

Chairman: C. A. SCOTT RIDOUT, M.S. (President of the Section of Laryngology).

Nasal Physiology and Its Relation to the Surgery of the Accessory Nasal Sinuses

By ARTHUR W. PROETZ (St. Louis)[1]

THE distinction between radical and conservative surgery is apt to be a personal one. Accordingly, it often happens that opinions are less diverse than they appear to be. The surgery of the sinuses has been based largely upon structure, and the conservation of structure has usually been regarded as secondary to the eradication of infection. The present study deals rather with conservation on a physiological basis and an increased regard for the conservation of function in operating. In the case of a limb, or an organ whose function is more apparently a necessity to life and health, the distinction is perhaps more easily made than in the nose. The physiological factors entering into nasal surgery are well known, but in order better to correlate them for the purpose of this discussion, I shall review them briefly. It is their interdependence which principally concerns us.

Most essential to nasal hygiene, in fact to the health of the individual, are the ciliated epithelium and the tough mucous blanket covering it, by means of which it conveys offending organisms quickly to the pharynx. Researches in recent years have directed attention to the cilia, and emphasized their hitherto unappreciated importance. It has been shown that the mucous coat exists as an unbroken, constantly moving blanket, which progresses from the most remote portion of each sinus to the pharynx in less than thirty minutes. Temporary gaps in the propulsive surface, provided these are not too extensive, are bridged over because the mucous blanket can be tugged over them by neighbouring cilia. So long as this blanket is maintained intact, no infection can occur. Although temporary lapses undoubtedly occur with some frequency, the restoration of both the epithelium and the mucous blanket is much more prompt and effective than was once believed.

It has been shown that the cilia are surprisingly hardy. The regeneration of surface layers is a matter of hours, or at most days. Regeneration can occur even when all the mucosal layers are stripped from the bone. Vigorously functioning ciliated epithelium is present even in chronic sinusitis, in the presence of pus, and

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while it does not necessarily occur everywhere in the sinus, at least it has been shown beyond doubt that the worst infected tunica propria may be covered with normal active ciliated epithelium. Extremely cold air may retard ciliary motion temporarily, but unless actually frozen, the cilia will respond with increased activity on warming. Likewise, their tolerance to heat equals that of any other protoplasmic structure.

Except for infections, there is in daily life only one condition to which they are vulnerable, namely, drying. Cilia are structures very old in the history of living matter. They are found serving various propulsory functions in the lower organisms. Sometimes they propel the animal itself, sometimes they propel food into the digestive tract, sometimes they repel injurious matters, but always they move in a fluid medium. When finally they appear in the respiratory tracts of air-breathing animals, there is invariably a glandular provision for bathing them in the required fluids. Drying, for even the shortest periods, destroys them.

Hilding (1932), by closing one nostril surgically, in dogs and rabbits, demonstrated that under-ventilation reduced or quite eliminated ciliated cells and brought about an increase in goblet cells. Over-ventilation likewise changed the epithelium, this time to the squamous type. When opened to the atmosphere, the mucosa of the dog's frontal sinus underwent definite changes, characterized by thickening and, in the more exposed areas, loss of cilia. Our own experiments have shown that if the sinus of a dog or rabbit is opened so that part of the respired air passes through the sinus, ciliary activity does not survive longer than a few minutes, as a result of drying. This is of the utmost importance in planning surgical procedures, as will be shown.

A mechanical factor often overlooked, especially in treatments requiring applied negative pressure, is the rigidity of the nasal chambers. Since the sinus walls do not yield to changes in pressure, whether respiratory or artificial, the only elastic medium is the contained air. It has long been known that the fluctuations of pressure in the nose and sinuses occasioned in the normal respiratory cycle is approximately ten millimetres of water. The maximum disturbance produced by a sniff or a blow is only fifty millimetres. As the former represents approximately one-thousandth of an atmosphere of pressure, it follows, according to Boyle's law, that one-thousandth part of air contained in any sinus passes through its ostium with each respiration. Thus, even allowing for diffusion, it requires somewhat more than an hour to effect a complete change of air in the sinus.

Obviously, evaporation is here at a minimum and therefore the relatively few glands to be found within the sinus are adequate for supplying the required moisture. Significantly, the glands are more numerous in the vicinity of the ostium, where the greatest air exchange takes place.

In a previous demonstration before the Section of Laryngology[2] it was shown that local drying, from whatever cause, produces a stasis of the mucous blanket and directly permits infection. Air currents in the nose are, therefore, important to the surgeon. By means of smoke streams, it has been possible to observe in some detail the air currents and eddies in the nose during inspiration and expiration. So far as they apply to inspiration, our experiments coincide in every detail with those generally accepted, and originally described, I believe, by Lambert Lack. On expiration, however, our air currents did not proceed via the inferior meatus but, in general, described an arc similar to the inspiratory one. This was to be expected, as there is nothing in the structure of the pharynx which might act as a baffle to deflect the air stream as it rises from the pharynx.

Two important differences were noted, however, between inspiratory and expiratory paths. First, the expiratory stream constituted itself a large eddy at the centre of the nasal chamber, occasioned by the constriction at the nostril which acted

[2] March 1934, reported in *J. Laryng. and Otol.*, **49**, 557.

as a baffle. Second, while the streamlined anterior tip of the middle turbinate and the relative recession of the middle meatus prevented any of the inspired air from entering the latter, on expiration the posterior tip permitted part of the eddy to enter the middle meatus from below. From the physiological standpoint this is significant, since the ostia in the depths of the middle meatus are protected from the cold, dry, possible dusty, inspired air and subjected only to the warm, humid air from the lungs.

Further, the ostium is an important organ intimately concerned with the hygiene of the sinus cavity, and not a mere opening which may be surgically eradicated. Under normal circumstances, the thin mucous coat working in a moist atmosphere passes unbroken along the walls of the sinus, converging at the ostium which passes it out into the nose. In a state of inflammation, when the mucus is excessive, the stream progresses to form a rope, or more properly a tube, as it leaves the ostium. It is only when complete closure occurs or the secretion is so excessive as to overwhelm the cilia, that mucus accumulates. Soon after the crisis is passed, the structures resume their activities and ropes of mucopus appear in the nose.

To conserve function, it is all-important that surgical procedures be planned so as not to destroy this cleansing mechanism. Certain and permanent destruction of the cilia follows the wide opening of a sinus when this is made in such a location as to direct the nasal stream of air against a sinus wall unprepared to deal with it. Such an opening establishes a condition comparable to that of the over-ventilated side in Hilding's rabbits, and renders the sinus forever incapable of cleansing itself. Whatever mucus the membrane manages to produce is so thickened by evaporation that it is not moved by the cilia, and promptly creates a condition favourable to bacterial growth. If these bacteria are toxic, there is trouble. If the surface is relatively protected, there is more or less fluid mucopus ; if exposed, there is crusting.

Attempts at sinus obliteration fall into one of three groups. The first, in which the walls are allowed to collapse and remain in contact with one another, is the only true obliteration. It is achieved principally in the more disfiguring frontal sinus operations. The second group, in which the cavity fills with granulations, is successful when it actually obliterates. If the filling with granulations is complete and orderly all is well. If there are pockets these are bound to be infected and to remain so, as the equipment for spontaneous cleansing is lacking. The third group is one in which one or two walls of the cavity are removed, as exemplified principally by the exenteration of sphenoid and ethmoid cells. It succeeds at best in removing two sides of a six-sided rhomboidal cavity, exposing the remaining walls to the respired air and depriving them of cilia.

It is not improbable that in countries such as Great Britain where the relative humidity is high, greater liberties may be taken in opening sinuses than in parts of America where extremes of climate often make for low natural humidity, and that produced by excessive indoor heating.

In this connexion, a slight digression may be of interest. It has been shown that in cold dry weather a considerable static electrical charge is developed and maintained on the surface of the body (including the nasal chambers) by friction with clothing and carpets. Not only can this be easily measured, but it has been shown to be a factor in eliminating, by adsorption, dust and other minute bodies from the air during inspiration.

Before attempting to formulate any operative principle, may I insist that no principle should be advanced as inviolable ? It is axiomatic that conditions arise to which any conservative measure will be inapplicable, conditions which, as in other fields, require removal and amputation. This, however, does not lessen the necessity for the utmost conservation of function whenever possible, and to my mind the skill of the rhinologist is directly proportional to his ability to decide how far he is to go.

My interest was first drawn to this problem by the unsatisfactory state which so often prevails after the wide opening of the face of the sphenoidal sinuses. Working

under Sluder, I had the opportunity of observing many patients referred to him as a last resort, after having undergone all manner of unsuccessful sinus operations. It was apparent that a large number of those whose sphenoidal sinuses had been widely opened were subject to constant discomfort, which the slightest respiratory infection whipped into active pain. Many of them had undergone more than one operation in what seems to me a misguided attempt to eradicate some remote undiscovered infected cell. In these sinuses, unprovided with the glands to cope with it, cold, dry and dusty inspired air was projected with each inspiration. Under the circumstances, the remaining sinus walls were forever prevented from regenerating a proper epithelium to keep them clean. Their squamous cell linings were in a constant state of irritation, as were the patients. Any attempt on the part of nature to close these openings was usually met with punch forceps. After fifteen years, these people still come for treatment whenever the weather changes!

Accordingly I have adopted as a routine procedure a more conservative opening, so placed as to protect the sinus lining, and more especially the lateral walls, from air currents. A small incision is made with a Sluder sphenoid knife, parallel to the septum and hugging it as closely as possible. This is a shortened version of Sluder's first cut. A keen-cutting punch forceps is inserted, and with every precaution against laceration, a clean-edged vertical opening is made which is only as wide as the punch forceps and extends as high as is safe and as low as is convenient. The ostium is not approached, but is preserved as a functioning, or sometimes only potentially functioning, mechanism. It is unnecessary to gnaw downwards into the thick floor of the sinus. We know now that little is to be expected from gravity, and that the less the bone is worried the better are the chances of maintaining the opening. In fact, the cleanly punched edges heal speedily and the opening continues patent. This opening permits inspection, ventilation, drainage, irrigation, in fact anything that the wide opening accomplishes. And in addition it allows the membrane to recover, it preserves a functioning ostium, and prevents the blast of inspired air from entering the sinus.

I have now twenty-two patients on whom I operated in this manner more than two years ago. None of them has any discomfort attributable to the operation. The results upon the conditions which prompted operation compare favourably with those accomplished by wide opening. Of this series, nine were operated upon for the relief of severe and protracted headache. Six of these obtained immediate and permanent relief. Two were improved, having milder attacks amenable to treatment through the opening. One was not benefited, nor did subsequent wide opening of the sphenoid in this case improve the situation. Of the whole group of twenty-two, three required reopening because of the formation of a fibrous web.

In the ethmoid capsule, which is less in the direct path of inspired air, the trouble is not so patent, but even in this location patients are more comfortable and complain less of crusting if too vigorous attempts are not made to clear away all the cell walls. The high removal of the anterior two-thirds of the middle turbinate,[3] followed by the judicious application of displacement irrigation, suffices. Obviously such methods do not apply when the cells are charged with a polypoid, degenerated membrane.

The satisfactory results which often follow the making of an antrum "window" in the inferior meatus are possible because this opening is small, relative to the size of the antrum, and is protected from the direct stream of inspired air, both by virtue of its position relative to the inspired air stream, and of the lower turbinate. As the ostium is untouched, conditions here resemble those in the sphenoid following the operation described.

[3] Owing to the "streamlined" contours of the anterior end of the middle turbinate and to the lateral recession of the middle meatus, the inspired air does not enter the latter, even when part of the turbinate is removed. The posterior tip, however, serves to divert the inspired air away from the sphenoid face and the expired air towards the meatus, and should, at least theoretically, be retained.

I have had better results with the external frontal operation when the frontal-nasal duct was disturbed as little as possible, than when attempts were made to enlarge it. These attempts seem rather to encourage proliferation of the infected tissue than the contrary, and lead to annular scars which are extremely troublesome wherever met. Annular scars, whether they occur in the œsophagus, the external auditory meatus, the urethra, the larynx, or the nose, are usually unmanageable. Obstructions by diseased mucous membranes are always preferable, as these have at least a potentiality of recovery. Wright showed that true fibrosis occurs late in the inflammatory process, and that until it has proceeded to an advanced degree, recuperation in great measure is possible. It is my experience that the end of the fronto-nasal duct, diseased though it be, is better drained by an unmolested membrane than by one torn and scarred by operation. It is often possible to establish temporary drainage through some adjoining cell, which may later become scarred without pocketing.

Summary.

Certain physiological elements of the nose have been briefly reviewed in an effort to promote a respect for their integrity, which mere structure has not enjoyed. Modified operative principles are advocated which will preserve function, wherever this is possible.

Neither these measures, nor any other single measure, is advocated as a routine procedure. Obviously certain conditions will not yield to them. On the other hand, when these conditions are absent, wide opening as a routine measure should be avoided, as it subjects many patients to needless post-operative discomfort and pain, which is often permanent.

[The paper was illustrated by a cinematograph film.]

REFERENCES

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Discussion.—GÖSTA DOHLMAN (Lund) said that, while agreeing in general with Dr. Proetz, he desired to emphasize one further point. He was sure that many of those present must have seen cases in which patients had been operated on, even conservatively, but in which discharge and crusts remained for years and could not be got rid of by any ordinary procedure. On the other hand, there were cases in which, sad to say, there had been very little indication for operation yet in which very extensive operations had been performed, even to the removal of much of the turbinates, and these patients had no crusts. He believed that in these cases the result of any procedure depended more on the metabolism of the mucous membrane than on the operation. He had had a patient who suffered from pharyngitis every two or three weeks all through the year. She was referred to him for tonsillectomy, which he refused to perform because he could not find anything wrong with the tonsils. She then had rheumatic fever and was again referred to him for tonsillar examination. Her oily skin and oily hair reminded him of metabolic disturbances in other patients with this condition, so he put her on a vegetable diet for three days a week, and on a low protein and a low carbohydrate diet for the rest of the time. Within three weeks the raised temperature, which had persisted for several months, disappeared, as did also the oiliness of the skin, and now, for two or three years she had had no attacks of pharyngitis. Another patient, who was suffering from melancholia, used to sit in his chair all day and lived on a high protein diet. He had nasal discharge and crusts, and a condition which looked like ozæna, but was not genuine ozæna. The crusts were removed and the nasal passages irrigated, but no permanent relief followed. The patient was then put on a purely vegetable diet and persuaded to take as much exercise as possible. Within a few weeks all the crusts had gone and the mucous membrane was, to all appearance, quite normal. Evidently the metabolism of the mucous membrane had to be taken into consideration in addition to the physiological aeration of the nose mentioned by Dr. Proetz.

ERIC WATSON-WILLIAMS said that the point which impressed him most in Dr. Proetz' work was the support given to the school of thought which had maintained a doctrine of

conservatism, particularly of the turbinal tissues. He had taught that when dealing with sinus disease the correct procedure was not to remove the diseased tissues as though one were taking out an appendix, but to provide the sinuses with a reasonable chance of normal ventilation, and then to leave them to look after the disease themselves, which, in the majority of cases, they did. Dr. Proetz' investigations supplied a reasonable basis for that line of argument.

E. A. PETERS asked what was Dr. Proetz' view upon the effect of oily sprays in dry noses in which the cilia had been more or less destroyed. Would a paraffin preparation or an almond oil base in certain cases afford relief? In his own experience it did so in some cases, but in others it appeared to have very little effect.

DOUGLAS GUTHRIE said that they were filled with admiration for Dr. Proetz' technique and the care he had taken in the presentation of his method by means of the excellent film. It was interesting that something conservative had come from America, because America had always been associated in their minds with radical procedures. Here, also, they had become more conservative, and although there remained a radical school, the majority of laryngologists were cautious in advising operation, and realized what not to do.

He desired to ask Dr. Proetz what was the function of the nasal sinuses. Some were of opinion that it was to produce voice. The sinuses seemed to have some effect on the voice, but on the other hand, as the outgoing vocal sounds did not pass through the nose, it was difficult to see what vocal function the sinuses could possess.

A. W. PROETZ (in reply), said that he was grateful to Dr. Dohlman for introducing the question of nutrition and metabolism. The subject of his paper, however, was the physiology of the sinuses, and he fully agreed that it dealt only with one part of a large subject. The physiology of the sinus must necessarily be dependent on the general physiology of the body. Many people thought they were getting a balanced diet when in fact their diet was not balanced at all. He recalled a young city worker who confined his diet to meat, potatoes, bread and butter, and ate nothing else. After three or four years he was almost a mental case. He was put upon a diet properly balanced with regard to vitamins and subsequently got well.

It had been asked why the sinuses opened after walking on a cold day. The answer was that if exercise was taken on a cold day more air was needed, and exercise promoted vasomotor tone.

The remarks of Mr. Watson Williams had appealed to him because of the careful judgment which he felt must be necessary before undertaking operation, whether radical or conservative. When he considered a radical nasal operation he always had in mind the irretrievable condition which resulted after amputation of the leg. Such amputation might be quite satisfactory, but it resulted in a one-legged man, and was only the best that could be done in the circumstances. A radical operation should not be regarded as the first recourse.

Mr. Peters had asked a question about the effect of oil as a spray. Oil did not mix with water any better in the nose than it did elsewhere, though when the mucosa was in a far advanced state of atrophy an oily spray might be useful. It had been found within the last year that inert oils, especially petroleum oils, taken day after day in the form of drops in the nose, got into the lung and produced a condition there which resembled silicosis in its final results. It led to pneumonia, especially in infants and old people, and it could be demonstrated at autopsy that there were pools of oil in the lung, causing a lipoid pneumonia. The inert mineral oils were the worst in this respect. Some work on the subject had been done by Walsh and Cannon at the University of Chicago, and was just about to be published. The best astringent was a 2% aqueous solution of ephedrine. This did not irritate the cilia and gave less systemic effect.

He was glad that Dr. Guthrie had mentioned the reputation of America for radical operations because it gave him the opportunity of saying that the tendency in America now was away from radicalism. He agreed that the practice twenty or twenty-five years ago was extremely radical, but many of these methods had been abandoned, though in one or two places they still persisted.

Dr. Guthrie had asked him what was the function of the sinuses. Probably the main function was to act as an air-jacket or insulator to protect, for example, the orbit, the nasal ganglion, or the pituitary, from the cold of inspired air. The normal temperature

of the nose in ordinary conditions was 30° C. The temperature there was much lower than the functioning temperature of all the neighbouring nervous structures. In the abstract, the structure might be regarded as resembling an automobile engine with its water-jacket, air spaces separating the surrounding parts.

A sinus would occur wherever two portions of a flat bone had to separate after ossification began. It was well known that the curvature of the face away from the skull became more and more disproportionate as adult life went on. The infant face was small and the forehead large. As the child grew towards manhood, the growth from the brow downwards was much greater, the inner table of the skull remaining in much the same position. The development of the face from the base of the forehead involved the separation of one bony surface from another. In the elephant, a frontal sinus would be found beginning over the eyes and going clear back to the foramen magnum. The same kind of thing happened in the case of the maxillary sinus. As the patient grew, the teeth came out into the mouth, leaving behind a vacant space where the embryo teeth had been. There was no machinery for regulating this space; the individual simply sucked in the mucosa like a spent balloon. The sphenoid grew into the bone laterally and downward as the face was growing laterally, and in exactly the same proportion and at the same relative speed as the face and neck were growing. He thought this explanation might serve, although it was rather involved in some cases, for all the various sinuses.

The Paranasal Sinuses in Children

By A. Bowen-Davies

In this investigation the maxillary antra in 55 children between the ages of 5 and 14 years were examined. The cases were derived from two sources. Many of them were referred by Dr. R. W. B. Ellis from the children's department at Guy's Hospital, where they had been found to be suffering from chronic pulmonary catarrh. The remainder were selected from patients attending Mr. W. M. Mollison's clinic at Guy's Hospital who had symptoms or signs suggestive of sinusitis.

In each case a routine investigation was carried out. An X-ray photograph was taken, the nose was cocainized and swabbed, and both antra were punctured, making a total of 110 antrum punctures. The washings from the antra were cultured and the antra filled with lipiodol. Further X-ray photographs were taken immediately and at intervals of a week or so, until the antra were clear of lipiodol. The volume of lipiodol injected and the time it took to disappear were recorded. In the early cases photographs were taken every twenty-four hours, and it soon became apparent that not only were the cost of the investigation and inconvenience to the patient too great, but the safe dose of X-rays would be exceeded before the antra were empty. By observing the progress of the lipiodol it was possible to space the X-ray examinations in such a way that the final examination coincided with the complete evacuation of the lipiodol.

For antrum puncture local anæsthesia was used with ease in all except four cases, in which the administration of rectal paraldehyde was required. The puncture was performed on the patient in the sitting position, and the child then lay down with a sandbag under the shoulders as recommended by Crooks. An attempt was now made to aspirate the contents of the antrum with a dry-sterilized glass syringe. If the antrum appeared empty, 2 c.c. of sterile saline were injected and aspirated. The specimen was immediately centrifuged and planted on blood-agar. A double trocar-and-cannula was not used, as such an instrument is large—a matter of some importance in dealing with small children; moreover, even with its use the risk of contamination is not entirely eliminated.

In the early cases, lipiodol was injected until the antrum was full. The capacity of some of the antra was found to be 8 c.c. or more, and it was decided to limit the injection to 5 c.c. This did not apply in the majority of the infected cases, since the capacity of the antrum was less than 5 c.c.

Of the 55 cases investigated, organisms were found in the antra of 23. Bilateral infection occurred in 12 patients, and of 110 antra 35 were infected. In 19 patients mucopus was found in one or both antra. It was present on both sides in four patients, and out of 110 antra, mucopus was therefore present in 23. In six of these the cultures proved to be sterile ; infected mucopus was therefore present in 17 antra. Infection without mucopus occurred in 12 antra.

The organisms present in the nose are very similar in both infected and sterile cases (Tables I and II). In each table the organisms are given with the number of times in which they were found. When these are compared with the organisms in the antra, the incidence of organisms is very similar if all cases of infected antra are considered, but if those which contain mucopus are considered separately, there is a striking change. The staphylococcus, which occurs most frequently in the other lists, does not occur, and its place is taken by the pneumococcus. Hæmolytic streptococci, hæmophilus bacillus, and *Micrococcus catarrhalis*, also occur frequently, whilst other organisms are rarely found. The pneumococcus rarely occurs in the antrum without mucopus being present. In the infected antrum without pus the staphylococcus again occurs most frequently, with *Micrococcus catarrhalis* next, but the hæmolytic streptococcus is present quite frequently whereas the pneumococcus is present once.

TABLE I.—ORGANISMS PRESENT IN NOSTRILS (CASES WITH NO ANTRAL INFECTION).

Staphylococcus	22	*Bacillus influenzæ* ...	5
Pneumococcus	13	Hæmolytic streptococcus ...	5
Micrococcus catarrhalis ...	13	Diphtheroids	3
Bacillus xerosis	11	Coliform bacilli	3
Streptococcus viridans ...	9	Sterile	13

TABLE II.—ORGANISMS PRESENT IN NOSTRILS (CASES WITH INFECTED ANTRA).

Staphylococcus	16	Hæmolytic streptococcus ..	3
Pneumococcus	10	Hæmophilis bacillus ...	3
Micrococcus catarrhalis ...	6	*Bacillus hoffmani*	2
Bacillus xerosis	5	Para-influenzal bacilli ...	2
Streptococcus viridans ...	5	Coliform bacilli	2
Bacillus influenzæ ...	3	Sterile	6

TABLE III.—ORGANISMS PRESENT IN ANTRA (ALL INFECTED CASES).

Staphylococcus	18	Para-influenzal bacilli ...	3
Bacillus influenzæ ...	6	*Bacillus xerosis*	3
Pneumococcus	6	*Streptococcus viridans* ...	1
Hæmophilus bacillus ...	6	*Bacillus hoffmani*	1
Micrococcus catarrhalis ...	6	Sarcinæ	1
Hæmolytic streptococcus ...	5	Coliform bacilli	1

TABLE IV.—ORGANISMS PRESENT IN ANTRA WITH MUCOPUS.

Pneumococcus	6	*Bacillus hoffmani*	1
Hæmophilus bacillus ...	5	*Bacillus influenzæ*	1
Hæmolytic streptococcus ...	3	Sarcinæ	1
Micrococcus catarrhalis ...	3	Coliform bacilli	1
Streptococcus viridans ...	1	Sterile	7

TABLE V.—ORGANISMS PRESENT IN ANTRA WITHOUT MUCOPUS.

Staphylococcus	9	Pneumococcus	1
Micrococcus catarrhalis ...	5	*Bacillus xerosis*	1
Hæmolytic streptococcus ...	3	Hæmophilus bacillus ...	1
Bacillus influenzæ ...	3	*Bacillus friedländer* ...	1
Para-influenzal bacilli ...	2		

The X-ray photographs were all taken with the patient in the supine position. Of 110 antra 66 appeared to be infected on X-ray examination. Of these 66, 27 subsequently proved to be infected and 39 proved sterile. It appears, therefore, that when the skiagram is positive the antrum will probably be sterile. Of the 44 cases with a negative skiagram 35 proved to be sterile and nine to be infected. It is therefore probable that an antrum which appears normal on X-ray examination will be sterile, but there is a possibility (one in five) that it may prove to be infected.

9.7.37.

13.7.37.

19.7.37.

26.7.37.

A series of skiagrams showing the progress of the evacuation of lipiodol. In the first (9.7.37) there is loss of translucency on the left. After the injection of lipiodol it is clear that the loss of translucency is due to thickening of the membrane. At the end of fourteen days both antra are free from lipiodol although some still remains in the ethmoid cells of the right side.

Of the 23 antra containing mucopus, 17 appeared infected on X-ray examination and six appeared normal. It has been the writer's experience on several occasions to see a negative X-ray photograph in a case of acute frontal sinusitis in which the sinus was subsequently found full of pus. The skiagram may not demonstrate the presence of mucopus. It will usually show a thickened membrane. It has never been able to demonstrate an organism, and it is in the deduction that a thickened membrane indicates infection that we are wrong. The pathology of a thickened

membrane without infection is obscure, but sometimes the condition may be of an allergic nature. It seems, therefore, that the X-ray photograph is of little value in the diagnosis of infection in the antrum.

The average rate of drainage in sterile cases was 4·9 days per c.c. of lipiodol. The average time for a complete evacuation was 17·9 days. This figure makes no allowance for the fact that many of the antra were not completely filled. In the infected cases the average rate of drainage was 4·9 days per c.c. of lipiodol, the same as in the sterile cases. The average time for a complete evacuation was 14·9 days. This was due to the reduced capacity of the majority of the infected cases. It is clear, therefore, that although the average rate of drainage is not affected by infection, the time required for a complete evacuation of the contents is less in infected cases. This is the important point, since in dealing with these cases it is the time required for a complete evacuation of the antrum which interests us. It appears, moreover, that obstruction to drainage bears little relation to infection. We must remember, however, that the antra were observed when they were full of lipiodol, and it is possible that in some cases the mucopus may be of such a consistency that drainage is not free. We have all seen cases in which this is quite apparent. The rapid evacuation of lipiodol does, however, prove that the function of the cilia is not affected by infection as we have been led to believe. It is a well-established fact that an infected antrum may be cured by drainage, and it follows that by providing free drainage we are doing what Nature has already been doing fairly efficiently.

Let us now consider the infected antrum which does not contain mucopus. It has been suggested that such an antrum is infected but is draining adequately. We have seen that all infected antra drain as rapidly as sterile antra, and in this series all antra containing mucopus were empty in fifteen days. An infected antrum without mucopus may be responsible for the symptoms in the type of case which we all see from time to time, in which the patient complains of nasal symptoms and we are unable to find any physical signs on which to base our diagnosis. It must have been the experience of all of us to have relieved such a patient by puncture of an antrum which appeared normal.

The formation of mucopus depends to some extent on the infecting organism. The pneumococcus was only present in the antrum on one occasion without mucopus also being present. The staphylococcus, on the other hand, was never present in pus. Certain organisms are present sometimes with pus, sometimes without, and the conditions under which mucopus is formed are not clear.

Originally it was intended to repeat the antrum culture in all the cases, but nearly all the patients improved so much that it did not seem justifiable to submit them to further antrum puncture. This improvement was seen, not only in the clinical condition of the patient, but also in the radiographic appearance of the antra, although few of them had become quite normal. This improvement must be attributed largely to the introduction of lipiodol into the antra. Its beneficial effect in pulmonary conditions is well known. Owing to a clerical error one case was submitted to a second antrum puncture at a week's interval. Although on the first occasion the antrum was found to be infected, on the second it was sterile. Antrum culture is the only means of proving infection in an antrum, and should be employed more than it has been in the past as a method of diagnosis.

Local treatment is of established value and the removal of tonsils and adenoids may be advisable. In this series the tonsils and adenoids had been previously removed in 34 patients. In infected cases they had been removed in 12 patients and were present in 11. In the sterile cases they had been removed in 22 patients and were present in 10. It appears therefore that the removal of tonsils and adenoids confers some protection from sinusitis in the child. I hope, however, that I have shown that the physiology of the infected sinus is not disturbed to the extent hitherto believed and that we should look further afield for the cause of sinusitis. Environment and

general hygiene, especially an abundance of fresh air, are important in preventing infections of the upper respiratory tract. If an adequate diet and plentiful supply of vitamins were provided for all children, the incidence of sinusitis would probably fall.

I am much indebted to Mr. Mollison and Dr. Ellis for permission to use their clinical material, to Mr. H. M. Worth and the radiologists for their help in taking the X-ray photographs, and to Dr. F. A. Knott and those who work under him, especially Dr. E. Sale and Dr. D. P. King, for their bacteriological reports.

REFERENCE

CROOKS, JAMES, and SIGNY, A. G. (1936), *Arch. Dis. Childhood*, **2**, 281.

Discussion.—A. W. PROETZ, with regard to the radiography of a sinus with lipiodol, suggested that the patient should be placed in the upright position and that the X-ray beam should be horizontal. When the patient was laid down and the beam went from above, it was easy to make a mistake between an incompletely filled sinus which showed a pool of oil and the effect produced by a thickened bone. When the patient was placed upright and the X-ray picture taken across, and a discrepancy appeared between the shadow of the oil and the shadow of the bone, then there was a pathological thickening. He had also found that if the lipiodol were diluted up to half with olive oil, making it less viscous, the sinus would empty, not in fourteen days, but in ninety-six hours, and this more rapid emptying might make the method more practicable.

KATHARINE GUTHRIE (Pathology Department, Glasgow Royal Hospital for Sick Children) asked whether any pneumococcal typing was being done. In her own department this had been done for some time now, and in antra where there was pus, pneumococci were often found. Was this confirmed in the author's experience?

T. O. HOWIE asked if Mr. Bowen-Davies had ever seen the lipiodol passing down into the bronchi. Had he examined these chests radiologically after the lipiodol had been passed from the antra into the respiratory tract, and did any of it pass into the lung?

A. BOWEN-DAVIES (in reply) said that he had left the question of the X-ray technique to the radiologists; he would keep himself better informed on that matter in the future. He would take Dr. Proetz' advice and ask the radiologist to make the radiographs with the patient in the upright position. In reply to Dr. Guthrie: The pneumococci had not been typed, and with regard to Dr. Howie's point: Examination had not been made to ascertain if lipiodol had passed into the bronchi.

CORRIGENDUM

Proceedings, 1938, xxxi, 1182, Sect. Laryng., 44 (Dr. Douglas Guthrie's remarks in discussion on Dr. Pressman's paper) line 4 . . . *for* "a swallowing part" *read* "a respiratory part".

Section of Otology and Section of Laryngology

JOINT MEETING IN ASSOCIATION WITH THE SCOTTISH SOCIETY OF OTO-LARYNGOLOGY

HELD IN GLASGOW, JUNE 10 AND 11, 1938

OTOLOGICAL SESSION

Chairman : F. J. CLEMINSON, M.Chir. (President of the Section of Otology)

Auditory Nerve Tumours

By PHILIP SCOTT, F.R.C.S.

THE title of this paper has been given as "Acoustic Nerve Tumours", but owing to the short time at my disposal I have been asked to stress the pathological rather than the clinical aspect of the subject.

During the last three and a half years I have been fortunate enough to obtain twenty-six temporal bones from patients who suffered from auditory nerve tumours, many of whom I had the opportunity of examining during life. Of these twenty-six bones, there are twelve still in the process of decalcification. I have chosen six bones, from the fourteen already cut in serial sections, upon which to base my observations to-day. I take this opportunity of saying that I am preparing a more complete survey of all these cases from clinical, surgical, and pathological points of view.

Owing to the co-operation necessary to obtain material and the labour involved in cutting serial sections of the temporal bones, it is perhaps natural that many of the papers on this subject are directed towards the clinical aspect. I am hoping to make out a good case for the routine pathological examination of both temporal bones, whenever 8th-nerve tumour has been suspected during life.

The late Mr. Theodore Just read an interesting paper [1] before the Section in 1930 upon the diagnosis of acoustic nerve tumours, based upon 33 unilateral cases examined by him in six years at the National Hospital. At the same meeting the late J. S. Fraser [2] and Mr. W. T. Gardiner reported upon 13 cases, one of which was bilateral, seen at the Royal Infirmary, Edinburgh, during eleven years. In March 1932 Professor de Klejn [3] and the late Dr. Albert Gray read a paper describing a case of acusticus tumour involving both auditory nerves in von Recklinghausen's disease. In December 1932 Mr. F. C. Ormerod [4] described a similar case in a patient aged 14. The pathological report on the left bone only was given by Dr. Gray [5] in 1933, together with that of another bilateral acusticus tumour in von Recklinghausen's disease.

Dr. Gray [5] said that apart from von Recklinghausen's disease acusticus tumours were practically never bilateral, and Mr. Norman Patterson quoted Henschen's statistics (245 to 24) and Harvey Cushing's (100 to 1).

Dr. Gray stressed the following points :—

(1) All three were cases of von Recklinghausen's disease.

(2) In all the cases the tumour was bilateral.

(3) New bone, similar to otosclerosis, was found in the labyrinthine capsule in two cases, and new bone in the apex of the cochlea in one case.

(4) Vacuolization of the cells of the stria vascularis in the first case.

In Mr. Ormerod's case the hearing in the left ear was normal two months before death, but histological examination showed a small deposit of tumour in the lowest whorl of the cochlea.

My particular interest in this subject was aroused by these papers and by the opportunity of examining several cases for Mr. Just at the National Hospital.

Of the three cases, which I shall now describe, one was examined by Mr. Just and the bone was given to me by Dr. Gray at the Ferens Institute, where I have had the privilege of preparing all my specimens; the other two patients were examined by me when I was acting for Mr. Just.

Case I (No. 158).—The patient, a woman aged 65, had had some degree of deafness in the left ear for twelve years, following otitis media, and for two years had had deafness in the right ear, also following otitis media.

She had had failing vision for two years and weakness of the right lower extremity for one year. She had had no vertigo, and no tinnitus.

Physical signs.—No facial asymmetry when in repose, but slight right facial weakness or ? left facial spasm. Eyes: 3–4 D papilloedema in each eye; vision: $\frac{6}{18}$; $\frac{6}{24}$. Nystagmus rapid and coarse on lateral deviation in both directions. Outward movement of the right eye slightly impaired. Left corneal reflex diminished.

Report on hearing (15.1.34): "Deafness in left ear; cannot hear by bone conduction (left), with noise-box in the right ear. Cold caloric test left: no added nystagmus, giddiness, or falling reactions. Left 8th nerve apparently not functioning in either division." Unfortunately there is no specific reference to the right ear.

I have deliberately excluded details of reflexes as being beyond the scope of this paper, but a diagnosis of probable left acusticus tumour was made.

No details are available of the operation performed on 1.2.35, but the patient died on the following day.

Report on post-mortem examination (Dr. J. G. Greenfield): When the brain was removed, "a soft acoustic neurofibroma was found attached to the left 8th nerve and entering the left internal meatus which was much eroded and enlarged, so that a piece of tumour the size of a bean was present under the dura mater. This was surrounded antero-externally by a cystic collection of yellowish fluid".

There is no mention of any other tumour masses or fibromata elsewhere in the body, but fortunately both temporal bones were preserved, and after decalcification I cut them in serial sections in the horizontal plane.

I wish to emphasize the fact that up to 24.1.35—one week before death—the clinical history was apparently taken by word of mouth. The house-physician records that the hearing then was the same as on 15.11.34, when the first report was made. The patient's husband, to whom I wrote in June 1938, confirms the fact that there was considerable hearing capacity in the right ear.

The sections from the left bone show neurofibroma filling the internal auditory meatus and extending outwards along the line of least resistance; the tumour has followed the nerve to the macula utriculi and expanded into the vestibule (fig. 1, Plate I). Earlier sections show the upward extension of the tumour mass in the vestibule, involving the ampullæ of the superior and horizontal semicircular canals. Sections lower down, passing through the stapes footplate and the modiolus of the cochlea (fig. 2) show this part of the vestibule and the saccule to be free from growth. There is no sign of otosclerosis in this bone. The cochlea at this level (fig. 3) shows almost complete degeneration of the spiral ganglion cells. There is also considerable change in Corti's organ; this latter is probably post-mortem disintegration.

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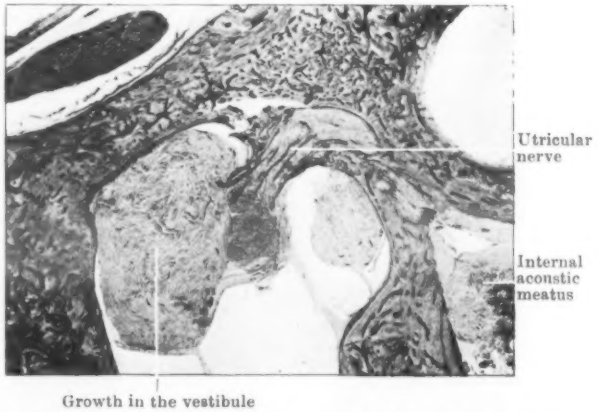

FIG. 1 (Case I, No. 158).—Left/220: The growth has followed the utricular nerve and destroyed the utricular macula.

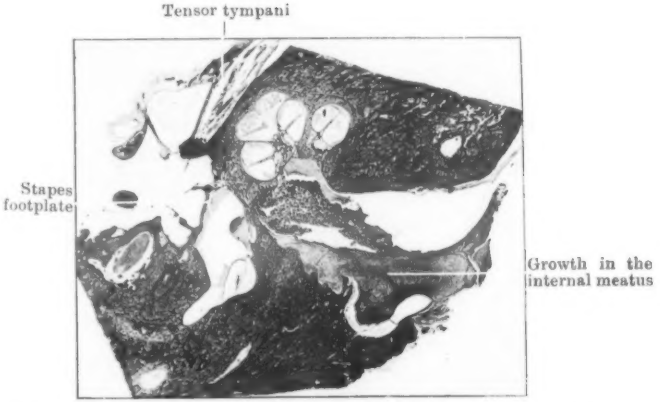

FIG. 2 (Case I, No. 158).—Left/270: Pressure expansion of the meatus by growth. Modiolus of cochlea and footplate of stapes free.

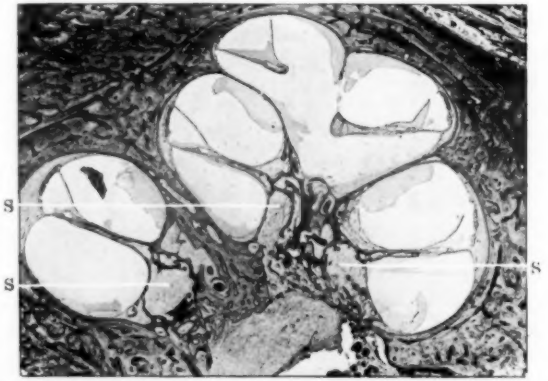

FIG. 3 (Case I, No. 158).—Left/270: Modiolus of cochlea. S = Absence of spiral ganglion cells. Albuminous coagulum in cochlea.

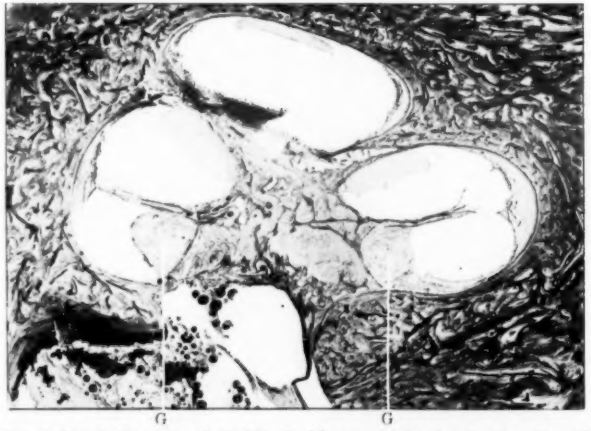

FIG. 4 (Case I, No. 158).—Left/250: Cochlea at a higher level. G = Growth spreading up the modiolus into the scala tympani.

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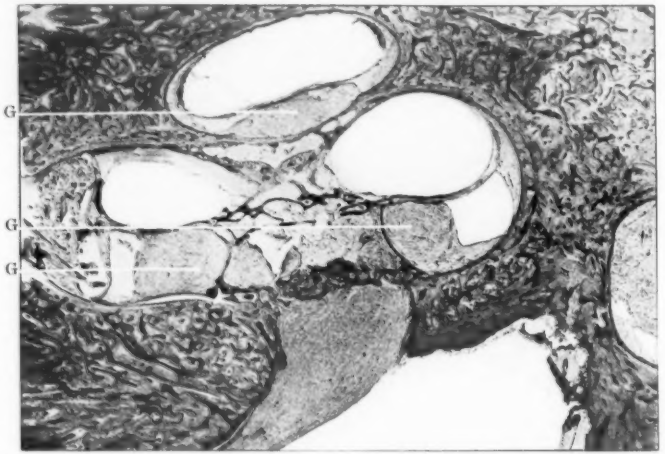

FIG. 5 (Case I, No. 158).—Right/240: G = Growth passing up the modiolus of the cochlea and spreading into the scala tympani.

FIG. 6 (Case I, No. 158).—Right/230: Growth in the lower branches of the vestibular nerve. Stapes free. No otosclerosis.

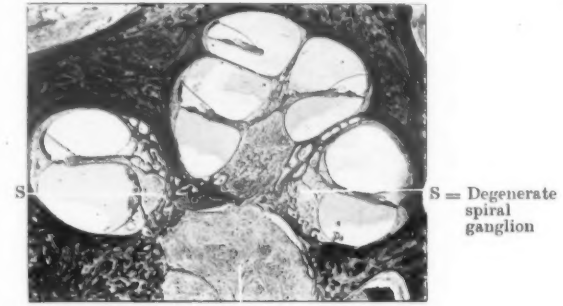

FIG. 7 (Case II, No. 183).—Right/310: Corti's organ well preserved. Few spiral ganglion cells. No spread of growth into the cochlea.

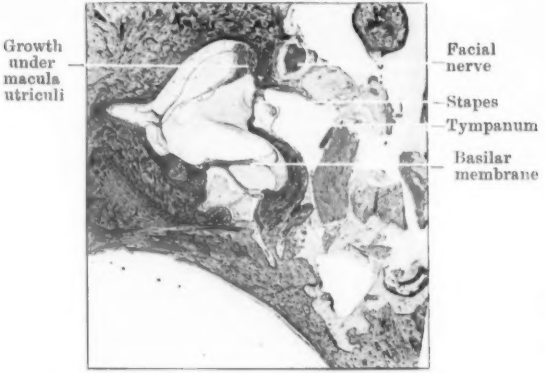

FIG. 8 (Case II, No. 183).—Right/510: Vertical section passing through macula utriculi, invaded by growth. Stapes free. Some coagulum in the vestibule.

Sections below the centre of the modiolus show growth filling the spaces of the modiolus and spreading outwards into the scala tympani. This growth is in direct continuity with that in the meatus (fig. 4).

One striking feature of this tumour is the presence of large numbers of psammoma degeneration bodies (fig. 2) usually found in meningiomata, but the typical palisade formation and whorling fibrous structure of true neurofibromata, seen well in fig. 1, establish beyond question the diagnosis in this case.

The right bone was examined for comparison, but in spite of the apparent ability of the patient to hear the spoken voice in the ear one week before death, this bone shows involvement by neurofibroma strikingly similar in distribution and structure to that found in the left. The growth is involving the vestibule and distorting the crista of the horizontal canal, of which only a remnant is visible, and there is also growth in the upper part of the cochlea.

In fig. 5 (Plate II) the cochlea is seen to be widely invaded by growth and sparsity of spiral ganglion cells is also apparent.

The stapes and the lower vestibule (fig. 6) show freedom from growth. In none of the sections described was any sign of otosclerosis or new bone-formation found, and later I shall refer to a possible explanation of Dr. Gray's [1] findings in this connexion.

CASE II (No. 183).—The sections next to be described were made from the temporal bones of a woman aged 50. The left bone was cut in the horizontal plane, and the right bone in the vertical, plane, in the line of the superior semicircular canal. This patient had a right-sided meningeal endothelioma, mostly in the middle fossa, so that many of the physical signs, although of extreme interest neurologically, are scarcely relevant to this discussion, but my reason for including the case is that a large tumour in the right ponto-cerebellar angle was noticed post mortem. This proved to be a neurofibroma, but after cutting sections of both bones, I found a much more extensive tumour in the left bone, although there was no evidence of this growth visible at the autopsy.

History.—Diplopia, two years ; deafness, three months. The first symptoms were referable to paresis of the left external rectus oculi, and later paresis of the right external rectus. Three months before admission the patient complained of deafness in both ears for the first time, and this progressed so rapidly that in from four to six weeks she became stone deaf, and all communication with her had to be made in writing. She had no headaches or vertigo, and only occasional slight tinnitus in the head—not referred to either ear.

Physical signs.—Eyes : 3 to 4 D papillœdema in each eye. Right, marked internal strabismus, with no movement outwards beyond the mid-line. Marked proptosis. Left, movement now full. On deviation to the left there was a fine horizontal nystagmus with a rotary element. No facial weakness. Co-ordination of limbs good : no dysdiadokokinesia. Cerebrospinal fluid : no cells ; protein 0·08%. X-rays showed bone destruction near the right optic foramen.

Report on ears (13.8.36) : " Tympanic membranes normal." Hearing tests : " She apparently hears no sound by air or bone conduction. Vibration of some forks felt, but not heard. Caloric and rotation tests do not give rise to any labyrinthine response. Galvanic reactions will be carried out." Conclusion : " Both labyrinths are defunct."

Operation (30.8.36).—A right-sided middle-fossa tumour was discovered. It was too extensive to be removed by one operation, and a second attempt was made on 25.9.36.

Dr. Greenfield reported as follows upon the tissue removed at the operation :—

" The tissue consists of irregular bundles and large whorls of fairly fleshy, fusiform cells with fairly large, oval, clear nuclei. Only a few small whorls are seen. There is much collagen, both as rounded knots and thick trabeculæ running irregularly

through the tumour. Mitoses are very rare, but a few definite figures are seen. Diagnosis: The tumour is an arachnoidal endothelioma (exothelioma).

Unfortunately the patient died soon after the second operation.

Post-mortem findings (14.10.36).—" A large mass of tumour adherent to the bone in the region of the right cavernous sinus. The bone in the region of the tumour showed superficial osteitis. A firm whitish tumour the size of a hen's egg lay in the *right* ponto-cerebellar angle, where it protruded as an easily detached tongue into the right internal auditory meatus. This tumour proved to be an acoustic neurofibroma. Two smaller, rounded sessile masses probably true fibromata, were found on the dura of the vertex." No other neurofibromata were found.

The sections obtained from Case II show on the right side—in which a tumour was noticed post mortem—a large mass of neurofibroma filling the fundus of the meatus, but although it is in close relationship with the facial nerve in this situation, there is no apparent involvement.

Fig. 7 illustrates a section of the cochlea cut in the vertical plane through the modiolus, and a higher magnification shows that the hair-cells are fairly well preserved, but there is a marked absence of spiral ganglion cells. There is no invasion by growth of the perilymphatic space. On this side the growth lay in the ponto-cerebellar angle and did not spread widely in the temporal bone, although a tongue of growth can be traced following the course of the utricular nerve, and expanding beneath the macula utriculi (fig. 8).

The routine examination of the unsuspected bone from the left side exposed the fact that a neurofibroma of much greater size filled the meatus and spread into the vestibule which, at one point, was completely obliterated (fig. 9, Plate III). From here the growth extended upwards to occupy the ampullæ of the superior and horizontal canals (fig. 10) where the crista are lifted up and compressed, the growth lying between the bony wall and the endosteum.

Unfortunately, owing to a slight error of orientation of the block before cutting, none of the sections passes completely in the plane of the modiolus, but I have examined the whole series in this neighbourhood, and can find very few spiral ganglion cells, although the organ of Corti is fairly well preserved. The stapes footplate is free and, as in the other bones described, there is no otosclerotic process.

As in the preceding case, the lower vestibular cavity and saccule are free, although the cochlea at this level shows invasion of the scala tympani (fig. 11B). The region of the fossula rotunda and secondary tympanic membrane is normal.

Case III (male, aged 60. No. 184).—The histological differentiation between acoustic neurofibroma and meningeal endothelioma is sometimes extremely difficult. In order to establish more certainly the nature of the labyrinthine tumours in the two cases described, I am also showing slides of sections from a third case—in the left temporal bone of which there is a tumour that is almost certainly an endothelioma. Sections from the right bone are also illustrated, as relatively normal, for comparison.

History.—Deafness: slow onset for two years. Staggering to left, and giddiness, for ten months. Impairment of speech, taste, and swallowing, for eight months. Headaches for five months. The onset of the deafness, two years before admission to hospital, was gradual for twelve months, by which time the patient was completely deaf in the left ear, but at this time he had no vertigo or tinnitus.

Signs.—Unable to sit or stand upright without support; falls or staggers to the left. No papillœdema; ocular movements full.

Nystagmus: Fine rotatory, on deviation to right; also on upward movement to right. Some wandering of eyeballs on looking to his left (? inattention; ? fatigue). No true coarse nystagmus. Left corneal reflex diminished. No facial weakness.

Hearing tests:—

Tympanic membranes natural.

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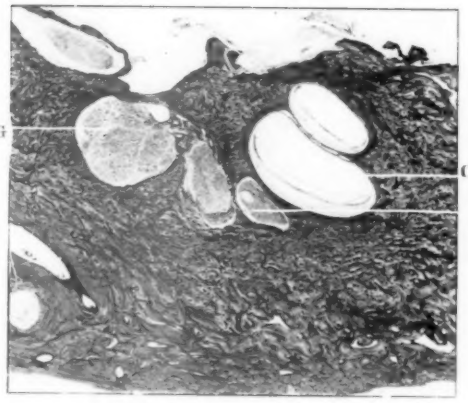

FIG. 9 (Case II, No. 183) — Left 150 : Left temporal bone (horizontal section). G = Growth completely filling the vestibule. No sign of the macula utriculi. Facial nerve free.

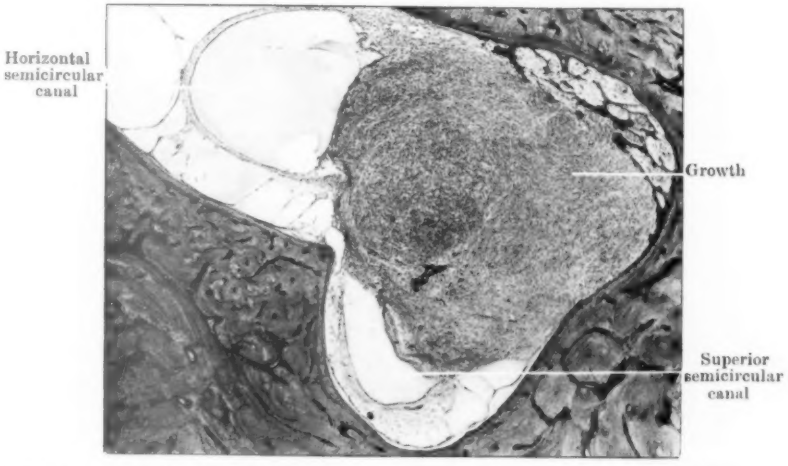

FIG. 10 (Case II, No. 183).—Left/100 : Ampullæ of the superior and horizontal canals distorted by growth which almost fills the space.

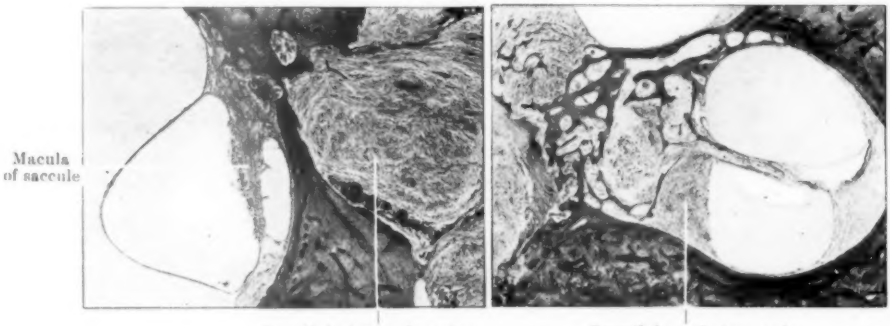

FIG. 11 (Case II, No. 183).—Left : (A) Macula sacculi with growth replacing the saccular nerve. (B) Growth in scala tympani. Note absence of spiral ganglion. Acellular congulum in scala vestibuli.

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PLATE IV.

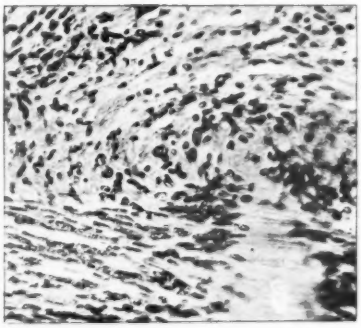

FIG. 12A. (Case I, No. 158.) Left.

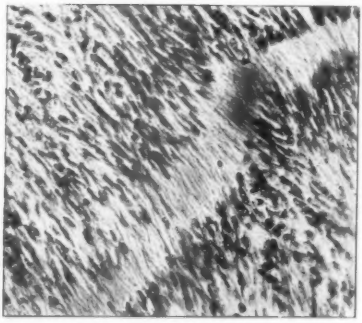

FIG. 12B. (Case I, No. 158.) Right.

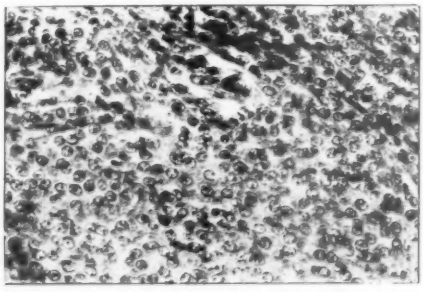

FIG. 12C. (Case III, No. 184.) Left.

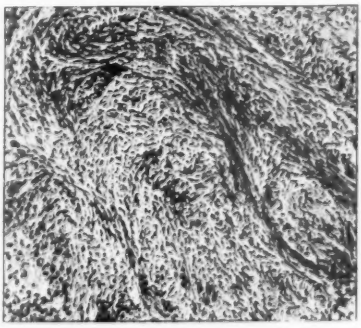

FIG. 12D. (Case II, No. 183.) Left.

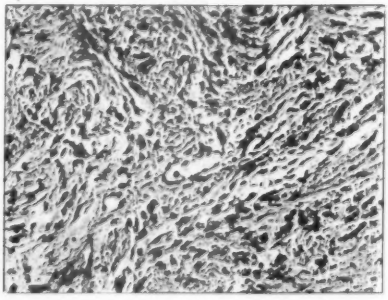

FIG. 12E. (Case II, No. 183.) Right.

FIG. 12.—Comparison of the five tumours.

PLATE V.

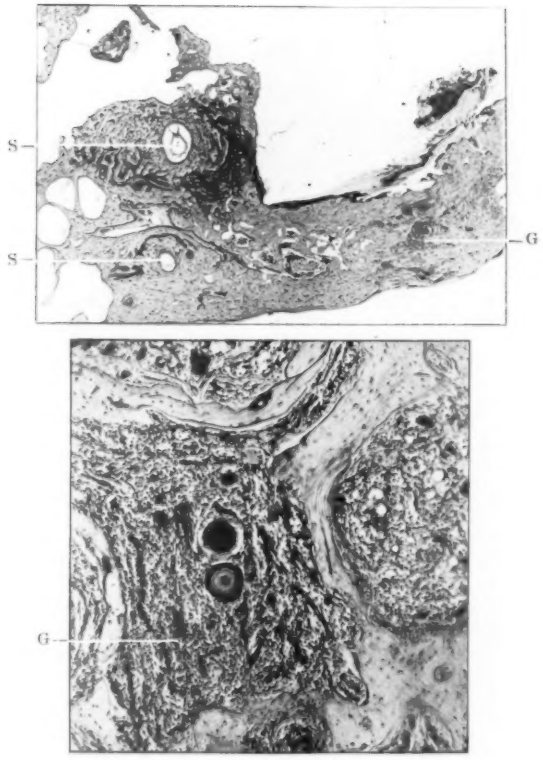

FIG. 13 (Case III, No. 184).—Left/100: A section cutting across the superior vertical semicircular canal, S. The apex of the petrous is invaded by endothelioma, G, seen under higher magnification in the marrow in the lower figure. S = Superior semicircular canal. G = Growth filling marrow spaces.

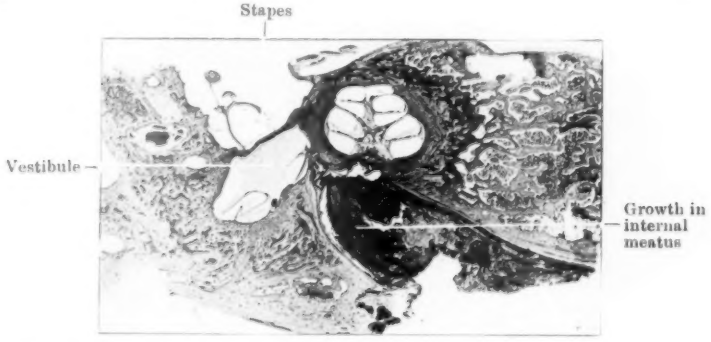

FIG. 14 (Case III, No. 184).—Left/270: Modiolus of the cochlea; footplate of the stapes. Vestibule contains coagulum. No spread of growth beyond the meatus. No otosclerosis.

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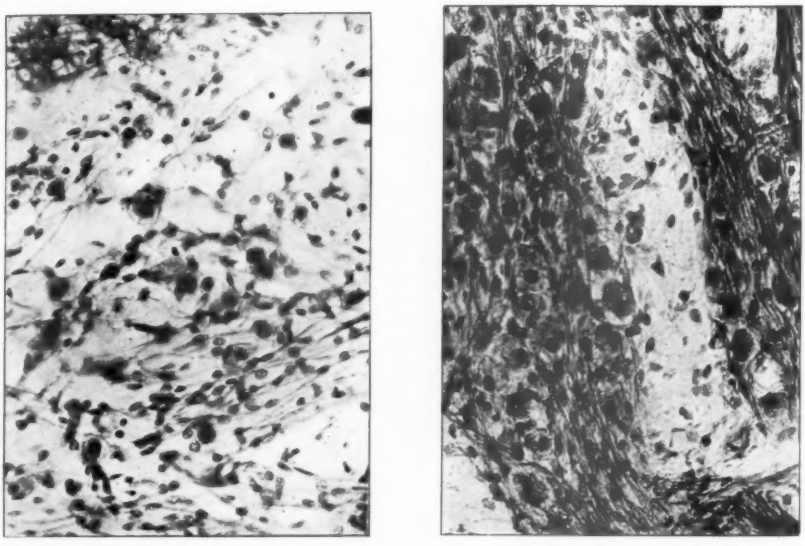
PLATE VI.



(A) Case III, No. 184, left. (B) Case III, No. 184, right.

FIG. 15.—The spiral ganglion from the left and right sides compared. Note sparsity of cells and remnants of nerve-fibres in the left figure.

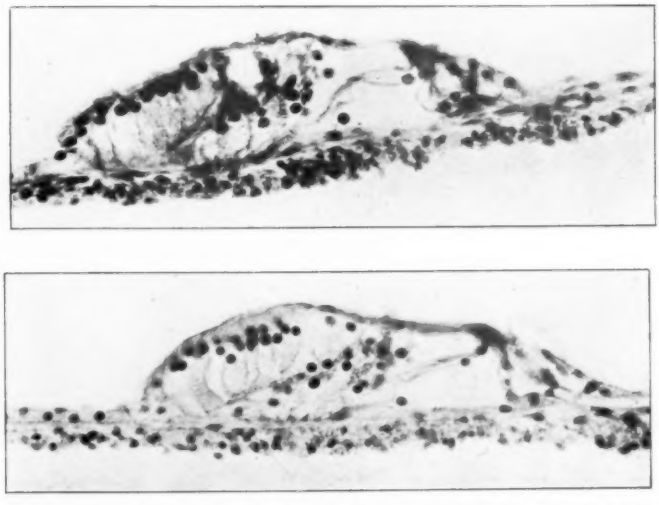


FIG. 16.—*Above:* Corti's organ from the left side, showing loss of differential staining. *Below:* Corti's organ from the right side, showing post-mortem degeneration.

Right ear: Hearing good. From 16 d.v. to C 5 (4,096 d.v.)—Bezold tuning-forks. Rinne positive. Bone conduction, using 256 d.v., equals that of observer. Whisper heard at 2 to 3 feet.

Left ear: Questionable if tuning-fork heard at all by air conduction (with noise box). Bone conduction: ? Heard 256 d.v. Rinne negative (probably pseudo-negative). Weber to right. Loud shout at 6 inches from pinna is not heard.

I reported as follows: "The left ear is very deaf; it is doubtful if any sounds are heard in this ear." One week later I confirmed this opinion.

Vestibular tests:—

Cold caloric.—Right ear: Nystagmus to left obtained in one and a half minutes, rapid and rotatory. Diminution of spontaneous nystagmus to right; this disappeared altogether about sixty seconds after ceasing the cold-water syringing. Vertigo present. Forced movements; patient almost fell out of the chair. One minute later, nystagmus to left and right; symmetrical. Five minutes later, returned to previous condition, i.e. fine nystagmus to right.

Left ear: No response. Nystagmus unchanged. No vertigo.

Rotation test.—Clockwise: Nystagmus to right almost obliterated. Definite nystagmus to left lasting five seconds only. No vertigo. Anti-clockwise: Nystagmus increased in rate and range to right; none to left. Vertigo present.

Conclusion: The right labyrinth is normal; the left is defunct, or nearly so.

I cut sections from the temporal bones, the left in the horizontal plane, and the right in the vertical plane. The tumour in this case is of strikingly different histological structure from that in Cases I and II (fig. 12, Plate, IV). The well-defined large, oval, cellular structure of the meningioma, with relatively little fibrous support, contrasts with the whorling fibres, small cells, and palisade formation, of the neurofibromata in the other cases. The difference is also displayed in the behaviour of the meningioma, which has not passed into the labyrinth and is confined within the meatus, except in the upper part, where it was found to have spread into the marrow spaces (fig. 13, Plate V).

The stapes, vestibular cavity, and round window are free (fig. 14), but high magnification of the cochlea, besides showing the usual deficiency in spiral ganglion cells compared with the normal—taken from the right temporal bone of the same patient (fig. 15, Plate VI)—shows an alteration in staining reaction of the organ of Corti which is interesting. To appreciate this difference it is necessary to compare the organs of Corti on both sides, which have been treated exactly alike, as to the time interval after death before fixation, and the details of decalcification and staining.

Fig. 16 shows two such sections, and even in the monochrome photograph the differences are apparent. In the upper figure, taken from the left or abnormal side, there is a maintenance of normal architecture, but a loss of differentiation of staining, the nuclei and cytoplasm being stained darkish blue. The lower figure maintains the usual differentiation between nucleus and cytoplasm. An almost identical change is found in the stria vasculosa from these cochleæ.

I showed these slides to Dr. C. S. Hallpike, who pointed out a similar change in a case of Ménière's syndrome at a recent meeting of the Section [6]. It is always a matter of considerable difficulty to say with certainty whether a given alteration from the normal is due to ante-mortem, or to post-mortem, degeneration.

The factor in which the two bones in Case III differ is the presence of a tumour on the left side. Dr. Hallpike's case showed a similar change without a tumour, but there was almost certainly increased intra-labyrinthine pressure, which would interfere with the blood supply to the stria vascularis and Corti's organ. In Case III it seems possible that a tumour of this size filling the meatus will have severely affected the blood supply to the same structures, while upon the right side in this case presumably only post-mortem degeneration is present.

It is difficult and unwise to draw conclusions from so little material, but it would be of practical interest if sections of the cochlea in suitable cases were examined from this point of view. A considerable step forward in the interpretation of temporal-bone pathology would be made if post-mortem degeneration could be more accurately defined.

The subject of interference with the vascular supply of the cochlea recalls the question of the causation of new bone-formation within the cochlea described by Dr. Gray in 1933 [3], and attributed by him to otosclerosis. Dr. Hallpike kindly allowed me to examine some slides taken from the cochlea of a cat, in which the internal auditory artery had been ligatured six weeks before death, without section of the auditory nerve. The cochlea in this case was almost completely obliterated by new bone-formation, identical in appearance with that which Dr. Gray described. This makes it more probable that in the other cases in which otosclerosis was found with auditory nerve tumours [4, 5] the otosclerosis was coincidental.

Summary

Two cases of bilateral acoustic nerve tumours are described and compared with one case of unilateral endothelioma.

In Case I deafness in the right ear was apparently not complete, although the cochlea was invaded by growth. This growth, as also the left-sided tumour in Case II, would never have been suspected if serial sections had not been cut from both bones.

It is possible that the statistics quoting the proportion of bilateral to unilateral growths are misleading, unless both bones from a suspected case have been examined histologically. I have so far examined temporal bones from ten patients with 8th nerve tumour, but in only three cases have I obtained both bones. Of these two were the cases of bilateral growth described in the above report.

These cases have not confirmed the findings of: (1) New bone-formation or otosclerosis. (2) Vacuolization of the stria vascularis.

Degeneration of the spiral ganglion cells is noted.

A possible explanation of the new bone-formation in the cochlea described by another observer is given.

There appears to be no direct connexion between otosclerosis and acoustic neuroma.

Some observations are made upon the changes in the staining reactions of Corti's organ and the stria vascularis on the side of a tumour in the internal meatus, and compared with those on the normal side.

In conclusion I wish to express my thanks to the Medical Committee of the National Hospital, Queen Square, for permission to refer to case notes.

This paper is part of the work in which I have been engaged as the Geoffrey Duveen Student of the London University.

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Discussion.—The PRESIDENT asked Mr. Scott whether in the 26 cases he had investigated he had met with the symptom of vertigo. Most of them would remember that there was described at one time—he thought by a German worker—a case of vertigo which, on post-mortem examination, showed an acusticus tumour invading the basal whorl of the cochlea. He would also like to know what was the present mortality rate following the operation for the removal of acusticus tumour. Many years ago—about 1909—

when going into the statistics, at a large neurological hospital of all the operations done there during the preceding ten years for tumours in the posterior fossa, including those for 8th nerve tumours, he had found the mortality very high indeed. The late Sir Victor Horsley was then on the staff, and his statistics stood out from the others because he was able to discharge from the hospital no less than 50% of his cases, though many of them were left with a permanent disability. Horsley was a great pioneer of neurosurgery but his method of operating was exactly the opposite of that now so generally adopted. He did the operation in two stages, each lasting about twenty minutes. During the first the dura was exposed and during the second the disease was dealt with. A year or two later he, the speaker, was privileged to see Harvey Cushing remove an 8th nerve neurofibroma at the Johns Hopkins Hospital. The operation took well over four hours and was done in one stage, and the ultimate result was excellent.

He had been interested in what Mr. Scott had said about bilateral fibromata, because in 1911 a friend of his was operated upon for an acusticus tumour on the right side by Horsley, and though the outcome was good Horsley had been much afraid that the patient might later develop a similar tumour on the left side. Clearly, in Horsley's opinion it was not an infrequent, but on the contrary a frequent, occurrence that auditory nerve fibromata should be bilateral.

Mr. Scott said that he had failed to find any of the little patches of otosclerosis which Albert Gray had illustrated by slides in his lecture after receiving the Dalby Prize. It was interesting to hear that they might be found as the result of trophic changes produced by failure of the vascular supply—a point on which Mr. Scott had quoted Dr. Hallpike. Perhaps in Gray's cases the tumour had occluded the artery.

Mr. ERIC WATSON-WILLIAMS said that he was interested, as a mere clinician, in three of the features which Mr. Scott had brought forward. In the first place, in the tumours which showed the new bone-formation, because he had been worried for years as to why an acoustic tumour should be associated with otosclerosis. Secondly, in the deposit of albuminous material in the cochlea: It was puzzling to the clinician that often the patient with an acoustic tumour, at any rate in the early stages, did not show the phenomena associated with nerve deafness: Fully half these patients had *ear* (conduction) deafness in the early stages and the only explanation he had been able himself to give was that they suffered from a condition of choked labyrinth. He thought the sections shown supported that idea.

Thirdly, how was a tumour such as this ever to be removed completely? One could remove the bulk of the tumour which was pressing on the cerebellum, but in a large proportion of Mr. Scott's sections the tumour actually went right through the temporal bone. The problem of complete removal appeared insuperable.

Dr. GÖSTA DOHLMAN (Lund) said that Mr. Watson-Williams had raised a question as to removing the whole of the tumour. Olivecrona, the neurological surgeon at Stockholm, did not employ the method that Cushing used. Cushing removed as much of the tumour as he could, but left the capsule. Olivecrona, on the other hand, took away the tumour inside the capsule, then cleared out the collapsed capsule and removed as much of that as possible. He claimed to get even a better result than Cushing did; the death-rate was not higher—in fact it was a little lower—with this technique, and while some relapses were sure to occur after either method, Olivecrona claimed to have fewer than there were among Cushing's cases.

Mr. PHILIP SCOTT (in reply) said that in only the third of the cases described had the patient suffered from vertigo; indeed, in that case vertigo had been one of the main symptoms. The tumour was histologically different in that case from those in the other two cases, in which vertigo had not been present, but he was unable to explain the anomaly on any histological ground. Speaking from memory, so far as he knew, the notes of the other cases also recorded absence of vertigo.

He had not yet gone into the question of the mortality rate, but, although he knew that this was still high, in four or five cases which he had examined either at Queen Square—or at St. Bartholomew's—Hospital, the patients were still very well, after the operation. Two other patients, whom he had seen more recently, had succumbed, but the mortality rate was probably lower than it used to be.

Mr. Watson-Williams had raised the question of the albuminous deposit. The striking thing to be seen in the slides which had accompanied the paper was that in one case—the third—there was albuminous coagulum in the labyrinth on the affected side only. That must have some possibility of a certain amount of vascular interference due to the pressure of growth in the meatus, or to the presence of growth in the labyrinth, causing the albuminous exudate, though this was sometimes seen, he believed, in temporal bones in which there was not any tumour. Some of it must, therefore, be regarded as possibly a "mortal-agony" exudate, with no cellular element at all. It did not appear to be an inflammatory reaction, although it had been called a serous labyrinthitis. It was difficult, however, from the structure of the exudate, to draw a correct conclusion.

The problem of complete removal of these tumours was obviously dependent on the early diagnosis. Many were rather slow-growing, and therefore if an earlier diagnosis could be made (and this, to a great extent, depended on the neurologist—not on the otologist) a considerable step would be taken towards the cure—or at least towards the great relief—of the patients in these cases.

The Otologist's Part in the Investigation of Suspected Brain Tumours

By T. O. Howie, M.B., Ch.B.

Since many of us are called upon to assist in the examination of patients showing symptoms of intracranial disease, the discussion of the otologist's part in such an investigation should be very profitable. The patients may, or may not, exhibit signs of involvement of the 8th cranial nerve or of some of its many connexions.

Although physiologists and histologists had made many advances in the study of nystagmus and the functions of the semicircular canals, it was left to Robert Bárány to correlate their findings. Using their material and carrying out many brilliant original researches, he applied these investigations practically to the study of oto-neurology. In recognition of these contributions to medical science he received many honours including, in 1915, the Nobel Prize. Other members of the Viennese School, Neumann, Ruttin, Alexander, and Kreidl, did much good work, both with him, and independently.

In America, following on Bárány's publications, the relations of the vestibular apparatus to the investigation of intracranial lesions were closely studied and important contributions were made by E. R. Lewis, I. H. Jones, Eagleton, and many others. During the past fifteen years papers by Magnus, de Klejn, and Bárány, have attracted attention to nystagmus in association with brain tumours.

In 1923 Nylén (successor to Bárány in the Chair of Otology at Uppsala) noticed a vestibular nystagmus when the head of a girl who was suffering from a subtentorial tumour situated in the pons was held in certain positions. This led him to study the significance of nystagmus in the diagnosis of brain tumours. He had observed that even the most experienced physician was occasionally led astray by symptoms not giving a proper lead. It was sometimes impossible to determine in which fossa the tumour lay. In surgical literature many cases had been reported in which a search had been made in the wrong fossa. In his monograph " A Clinical Study on Positional Nystagmus in Cases of Brain Tumour ", he says : " Might it not be possible to avoid such mistakes if more consideration were to be given to the symptom described as positional nystagmus ? " In this publication he discusses 150 cases of brain tumour which he had investigated between 1923 and 1929.

When called upon to examine a case of suspected brain tumour, we may be asked to determine the origin of such symptoms as deafness, nystagmus, or perhaps vertigo. It is well known that any or all of these may be produced either by a disorder of the

inner ear, or by some intracranial lesion. Frequently symptoms arising from a lesion of the cerebellum may closely resemble those seen in disease of the internal ear. It is in such a case that the otologist, by careful functional testing of the cochlear and vestibular apparatus, may determine the source of such symptoms.

The existence of a peripheral lesion may be suggested by the following findings :—

(1) Impairment of the functions of both cochlear and vestibular portions of the 8th cranial nerve.

(2) Complaint, or history, of tinnitus.

(3) Proportional loss of function in the vertical and horizontal canals.

(4) Proportional decrease in the reactive nystagmus and vertigo, to stimulation.

From these few instances it will be seen that in cases of peripheral lesion the responses to stimulation show, as one would expect, proportional loss of function.

Where a central lesion is present one of the following may be found :—

(1) Normal hearing, but disturbances of vestibular function.

(2) Normal responses on stimulating the horizontal canals, but loss or impairment of responses from the verticals.

(3) Normal vertigo and nystagmus, but loss of past-pointing or of falling reaction.

(4) Normal vertigo, but impaired nystagmus (or the reverse) from the stimulation of any canal.

Spontaneous nystagmus of increasing intensity or long duration is always of central origin, while nystagmus from a diseased labyrinth or irritation of the vestibular portion of the nerve trunk (as in acoustic neuroma) is more intense at first and decreases, to disappear in the course of a few days. Spontaneous vertical nystagmus is always of central origin. It cannot be produced peripherally.

Speaking generally, it is possible to determine whether a deafness is of the middle-ear or nerve-lesion type. In spite of numerous fallacies in our time-honoured tests, experience has proved the results to be, in the main, accurate. We must remember that this is a clinical examination, applied frequently in the course of our routine work. Time is not available for prolonged scientific investigation. We, as clinicians, must leave the theories and experimental work to our more scientific colleagues, and hope that they will be able to devise more accurate tests, at least less time-consuming than those at present in use.

By vestibular tests the integrity of the labyrinth and its connexions with the oculomotor centres, the cerebellum, and the sensory cerebral cortex, may be examined. For example, if after rotation and cold caloric tests, normal responses of nystagmus and past-pointing are obtained, one is entitled to infer that the cerebellum is intact. Again, if nystagmus is absent, but vertigo develops, then there is likely to be a lesion in the vestibulo-oculomotor tract, after it has separated from the vestibulo-cerebello-cerebral bundle. These are some of the conclusions one may draw.

Turning now to the question of localization of lesions in the tracts : Considerable doubt has arisen as to the interpretation of the nystagmus and other reactions resulting from stimulation of the vestibular apparatus. Bárány and his followers in Vienna thought that they could localize lesions in the brain, especially those situated subtentorially, by studying the responses to vestibular stimulation. Jones and Fisher have made even more enthusiastic claims ; they have drawn up tables and have claimed that by filling up such a table one can locate exactly a small fascicular lesion. This looks well on paper but experience shows that cognizance had not been taken of the anomalies arising from increased intracranial pressure. The extraordinary effects of this are nicely shown in paralysis of the contralateral abducens nerve, in certain cases of otitic hydrocephalus.

The neuro-surgeon Sachs in "Diagnosis and Treatment of Brain Tumours" (1931), says :—

"As observations accumulated, however, and were critically analysed, the enthusiasm of the first years subsided somewhat. Sources of error were discovered, for instance the pathways through which the vestibular nerve acts are crowded together in the floor of the 4th ventricle and in the pons. Almost every posterior-fossa tumour very soon causes an obstruction of the aqueduct of Sylvius and the accumulation of cerebrospinal fluid in the ventricles presses on these pathways. Consequently, many of the disturbances described by Bárány, instead of being evidence of a focal lesion, are probably merely evidence of internal hydrocephalus. Where little or no internal hydrocephalus is present, as occurs in acoustic tumours, the Bárány tests may be of tremendous value."

Sachs also points out that the application of caloric and rotation tests to a patient in whose case they are likely to be of some value, is sometimes a source of danger. It may lead to an increase in an already high intracranial pressure : death from this cause has been recorded. From his own point of view he is inclined to use these tests much less frequently.

De Martel and Guillaume (1934) speak of a symptomatic tripod consisting of nystagmus, Romberg, and segmental deviation, i.e. the deviation of both arms or the body towards the side of the slow phase of the nystagmus. This pattern is purely labyrinthine. Any modification of the reciprocal direction of these phenomena constitutes a disharmonious syndrome, indicating participation of the cerebellum.

Their views on the vestibular tests are somewhat similar to those of Sachs, i.e. that they add a danger in the case of patients subject to paroxysms of hypertension, and also that the function of the vestibular apparatus and tracts is upset, not only by the direct action of the lesion, but also by the action of the intracranial hypertension. They consider that the signs of hypertension suggested by Ruttin, Bárány, Eagleton, and others, are confusing ; some observers gave hyperexcitability, others hypo-excitability, of the vestibular apparatus, as a certain indication of increased pressure.

During a recent visit to Scandinavia I saw cases examined by otologists for the neurologist and the neuro-surgeon. Professor Nylén kindly demonstrated cases showing positional nystagmus. I have looked for this symptom since my return and have found it present in cases where no spontaneous nystagmus could be recognized.

Nylén has written extensively on positional nystagmus, and in 1925 suggested that it might be a valuable diagnostic sign in the investigation of brain tumours. In 1931 he stated that his experience had since then, to a large extent, confirmed this supposition. His paper of 1931 was based on 150 cases of brain tumour examined personally. Since then he has examined over 500 further cases of intracranial disease.

His technique is as follows : The patient is examined for nystagmus, with the head and body in various positions.

(1) Sitting, with the head in the upright position.
(2) Body supine, face directed to the ceiling.
(3) Body supine, head first on one side then on the other.
(4) Body supine, head hanging back, neck fully extended.
(5) Body prone, face directed to the floor.

The various positions are taken up slowly, to avoid stimulation of the semicircular canals. Nylén advises the use of Bartel's spectacles to observe the nystagmus. He always makes the positional nystagmus test first, even without a history. In this way he is able to carry out a purely unbiased investigation. He prefers not to be influenced by the result of cochlear and vestibular test findings.

When the positional nystagmus test has been completed and recorded, and a brief history has been obtained, caloric, rotation, and cerebellar, tests are carried out. These are followed by a hearing test, the ophthalmoscopic findings are noted, and from consideration of all the material, deductions are drawn.

He claims that, while most writers state that tumour in the posterior fossa shows nystagmus in from 50–60% of cases, he has found it in 90% of cases, when examined by the positional method. He found positional nystagmus in only 4% of cases in which the tumour was situated in the anterior, or middle, cranial fossa or spinal cord.

The nystagmus produced positionally is of the vestibular type and is coarse and irregular. It does not usually appear at once on taking up the position of the head, but after a latent period of two or more seconds. It soon reaches its maximum and persists while under observation. It must be of at least the second degree before one can draw definite conclusions. The irregular movements are often to the tumour side, while more rapid and regular ones show to the sound side.

Nylén recognizes two main types :—

Type I.—In this the direction of the nystagmus changes when the position of the head is reversed.

Usually it shows a combination of horizontal and rotary movements, the horizontal being directed away from the lower side when the head is in the lateral positions. It is most readily demonstrated on taking up these positions from the supine.

Type II.—In this the direction does not change with changes in the position of the head.

Certain positions produce the nystagmus, or influence its intensity. It is, in most cases, produced in the lateral positions.

From his analysis of 75 cases of tumour in the posterior fossa Nylén draws the following conclusions :—

(1) The presence of positional nystagmus, Type I, makes it probable that a suspected brain tumour is situated in the posterior cranial fossa.

(2) Distinct positional nystagmus, Type II, makes this position probable, but is not of the same importance as a symptom as Type I.

(3) Type I is more usual in intracerebellar tumours (gliomata) and Type II in cases of extracerebellar tumours (meningiomata and neurinomata).

(4) Positional nystagmus with a vertical component indicates a tumour in the higher reaches of the posterior fossa, or if this component is dominant, one in the incisura cerebelli.

(5) If the positional nystagmus is strongest when the patient is lying on one side, this is a slight indication that the tumour may be on that side.

He explains the mechanism by means of diagrams, showing pressure or traction in the region of the vestibular nuclei and the substantia reticularis, or in conducting passages closely connected with these centres.

To obtain the information from which we can draw our conclusions, we must follow some system of examination. After seeing the diversity of methods used in other clinics and reading reports of examinations carried out by other otologists, I feel that an endeavour should be made to develop some standard form of examination routine. How often do we find it impossible to follow, from the notes of functional testing made by another observer, the extent of involvement of a cochlear branch, or the amount of impairment of vestibular function ? I have seen nystagmus referred to as "nystagmoid movements". On many occasions no note is recorded of the direction.

So that members can offer their criticism and perhaps give suggestions from their own experience, I shall here give a short description of the routine followed in my hospital.

(1) Examination of nose, nasopharynx, and larynx. Apart from focal sepsis or invading growths, this may reveal palatal or laryngeal palsy, of central origin.

(2) Otoscopic examination to exclude cerumen and to determine the state of the tympanic membranes and of the middle ears.

(3) Assessment of hearing, using the speaking voice, and shutting out the other ear by means of the "noise-box".

(4) Weber, Rinne and Schwabach tests, using 256 d.v. fork.

(5) Assessment of tone perception, using range of forks from 32-4,096 d.v.

(6) Testing of upper tone-limit on the monochord.

(7) Positional nystagmus tests have been introduced at this stage.

(8) Cerebellar tests, i.e. finger nose, diadokokinesia, rebound phenomenon, grip, spontaneous past-pointing (testing both hands together), Romberg, and walking with the eyes shut.

(9) The cold caloric test, to prove the activity of the vertical canals. 10 c.c. of water at 27° C. are used. This is an excellent test for hyperexcitability. Should this produce no result, further syringing is carried out using 50 c.c., then 100 c.c., and up to 200 c.c. Should there be still no response, 50 c.c. at 17° C. are tried before the vertical canal is held to be unstimulable. (This is the method employed in Serafima Lazarett, Stockholm.)

(10) The rotation test: The horizontal canals on both sides are examined after rotation on Bárány chair.

(11) Lastly, deductions are drawn and recorded.

I have not the time at my disposal to review some 25 cases of lesions in the posterior fossa examined during the past four years, but will say, in conclusion, that we have not been able to give such accurate localization as earlier literature leads us to expect. I hope that the introduction of the positional nystagmus test will improve the results. Cases of acoustic tumour have given the best picture, but we have yet to find and diagnose one in the early stages, before there is some increase in the intracranial pressure. It is a great responsibility to ask the neuro-surgeon to explore the cerebello-pontine angle on otological symptoms alone. I have seen cases showing symptoms strongly suggestive of neuroma, where operation revealed no tumour. I have, on the other hand, investigated cases sent in with the diagnosis of acoustic tumour, in which a thorough investigation has shown that the classical symptoms did not exist.

Cushing once complained bitterly against the otologist for failing to recognize the classical symptoms of acoustic tumour, and subjecting the patient to meddlesome surgery in a futile effort to improve the hearing. The neuro-surgeons are still complaining that the intracranial case, with deafness as a symptom, is too late in reaching them. On these grounds alone I feel that the question of functional testing requires our serious attention, and more thorough practice.

Discussion.—The PRESIDENT said that Mr. Howie had brought out a number of points of great interest. One of the most important was that of positional nystagmus and its significance as an aid to diagnosis in tumours of the posterior fossa. He had been a little puzzled to know why Mr. Howie had described the cold caloric test as being a test only for the vertical canals. His own experience of that test was that while with the patient's head in the 30° forward position (for testing the vertical canals only) there might be no nystagmus, yet if the head were turned back through 90° to secure the maximum effect from the horizontal canal, there might at once appear a very marked nystagmus with nausea and past-pointing. The method Mr. Howie had described of making the cold caloric test had interested him. He himself always gave a fairly rapid injection of 10 c.c. of water at 63° F. at intervals of half a minute and if at the end of five minutes there was no nystagmus in either the forward or backward position of the head, he regarded all the canals as being completely unresponsive to the test.

Mr. E. D. D. DAVIS said that those attached to a general hospital often saw these cases; usually the patients were very ill. Had Mr. Howie found the rotation test of any real value? He (the speaker) also had seen Dr. Nylén carrying out the positional nystagmus tests at Stockholm. He had a mechanical table which he could turn in any direction he liked. It was a long and complicated procedure, and one which could not be condensed to a few simple points. With regard to the caloric test, he himself used Dundas-Grant's cold-air apparatus which was very useful, as it made a quick test which did not upset the patient much.

Mr. TERENCE CAWTHORNE said that he had seen cases of this kind at the National Hospital, Queen's Square, and one or two points which he had found during his examination of the patients might be worth mentioning.

The first was with regard to nystagmus. By the time that these cases of 8th-nerve tumour were seen by an otologist the nystagmus was no longer of a labyrinthine type, but was then probably due to pressure on the pons and usually it was found in both directions; that is, on the patient's looking either to the right or to the left; on his looking to the affected side, the phase was usually slower.

Mr. Scott, in reply to the discussion on his paper, had said that it would be a great help if neurologists, dealing with the disorders of the central nervous system, would refer these cases earlier to the otologist for diagnosis. His (the speaker's) own impression on going over the history of these cases was that the otological signs were first to appear. The patient often complained of deafness, vertigo, and tinnitus, for some time before the central nervous system symptoms arose. Possibly, therefore, it was the otologist who should first see and diagnose these cases.

It had always been hoped that the otologist might afford some help to the neuro-surgeon, but he was afraid that the help was not very great, except with regard to lesions in the posterior fossa. The otologist could say whether a lesion was extracerebellar or intracerebellar and pontine, and this information was of great importance to the neuro-surgeon. In a case in which there was marked disproportion between the function of the cochlea and that of the vestibule, the otologist could say that the lesion was likely to be intracerebellar. He could not say whether it was a tumour, a vesicular lesion, or a degenerative lesion, but he could say that a patient who had a certain amount of cochlear function and marked vestibular loss was likely to have an intracerebellar or pontine lesion which was very often an inoperable condition.

A quantitative vestibular test would be of the greatest value, but this was extremely difficult to carry out at the moment. A caloric test was very well so far as it went, but many varying factors came into it, e.g. the thickness of the tissues between the syringing fluid and the inner wall of the middle ear and things of that kind. The only way to get a quantitative test was probably with rotation.

It was very important when making a tuning-fork test to be quite sure that a noise-box was used. In some of the cases which he saw, he found that although they had been examined thoroughly the results were not accurate because a tuning-fork had been used, without a noise-box, to test bone conduction.

He would like to know for how long Mr. Howie syringed when he was carrying out a caloric test. It was not only the amount of fluid (10, 50 or 100 c.c.) that was important—the duration of the syringing was probably more important still. At Queen's Square Hospital he had been using 100 c.c. of water at 60° F., and syringing for thirty seconds. There were many other—perhaps better—ways but he had found this method very convenient.

Mr. THACKER NEVILLE suggested that the rotation test should be discarded as useless. The caloric test might simply be used alone; for this he personally used ice water—and only a few drops. The test should be carried out with the patient lying down, so as to act upon the vertical canals.

The noise-box had not, he thought, any particular value and indeed it seemed to him misleading. Instead of employing a noise-box it would be better to put a piece of paper over the ear and rub it, or to get a nurse to rub the ear with the hand.

Had Mr. Howie used the star test (Babinski-Weil's test)? It was much used in France and he (Mr. Thacker Neville) had found it serviceable.

Dr. SIMSON HALL said that testing for nystagmus with the head in varying positions was reminiscent of the tests elaborated by Magnus and De Klejn some years ago. Did Mr. Howie employ any pointing test in conjunction with the positional nystagmus test? His own experience of these earlier tests was that they did not offer a great deal of information. The methods which he then used were similar to those described by Mr. Howie.

Dr. GÖSTA DOHLMAN (Lund) said that in the minds of some speakers in the discussion there was evidently a feeling of uncertainty with regard to rotation tests, and doubt had also been expressed about the caloric test. He had had the same feeling himself, and had tried to find a reason for it. He had therefore carried out his rotation tests in quite another way from the usual one (ten rotations and then a stop). When ten rotations were given and then a stop there must be—as he hoped to show later in a cinematograph film—a very wide movement of the cupula, which would afterwards return to the normal position. The only thing measured physically by this rotation test was the resistance of the cupula and the time

taken for its return to the normal position. If a quantitative test was to be obtained by rotation one should employ only the lowest degree of stimulation; he had tried to carry this out, gradually increasing the speed of rotation and at the same time registering the eye movements. By turning the chair at certain definite rates, it was possible to get angular movements of acceleration or retardation, and in that way it might be possible to obtain the threshold value of the stimulation of the vestibular apparatus in its peripheral parts. But the reaction was still more complicated.

He had made some measurements of the rapidity of the reaction to stimulation in the vestibular nerves. The result showed that the vestibular nerve reacted very slowly, and that might give an explanation of the way in which the eye movement in the slow phase of nystagmus was obtained. The first result of stimulation of the vestibular apparatus was a slow movement, but he felt sure that the rapid movement must also arise from the vestibular nuclei. The nuclei were made up of large cells and small cells. Those with the small cells were directly connected with the vestibular nerve; these, he would claim, produced the slow movement. The rapid movement was obtained by stimulation of the nuclei having the larger cells. That being the case, it was very difficult to obtain anything strictly quantitative from these tests.

For a perfectly quantitative test it was necessary to know the exact degree of stimulation of the peripheral organ, the rate of reaction of the nerves, the changes under different conditions—as, for example, under high intracranial pressure, and so on—and the mode of reaction of the larger cells in the vestibular nuclei—i.e. the cells that gave the rapid reaction. If all these data were known it would not be hard to create really quantitative tests.

Dr. A. W. PROETZ said that as the names of Fisher and Isaac Jones had been mentioned it would be well to remember that their work was done in 1920 or thereabouts, and their results were those of early investigators who probably were too optimistic. Sachs, on the other hand, wrote his work about ten years later. He was extremely sceptical of the earlier work. As far as the caloric tests were concerned, those now used in America were designed by Lorente de Nó, an extremely able Spanish otological physiologist at present working in New York. He used 100 c.c. of ice-water in something less than thirty seconds, and his results represented a gain in accuracy. Complaint had been made during this discussion that the tests were complicated, but he did not think that complaint should be regarded as valid. After all, some of the things that were most necessary were the most complicated, and otologists should train themselves to carry out the tests.

Mr. PHILIP SCOTT said that with regard to the cases seen by Mr. Howie in which there had been symptoms strongly suggestive of neuroma whereas operation had shown that no tumour and was present, possibly the pathological signs had been quite correctly interpreted and the tumour had been missed at the operation, as might easily happen. In two of the cases which he had described in his paper the tumour had not been found post mortem until after histological section.

Mr. Cawthorne had commented on his (the speaker's) remark that the neurologist, not the otologist, should make the diagnosis in the first instance. Though he agreed with Mr. Cawthorne that the deafness was often the first symptom, he found that unfortunately very often the patient did not complain much about the deafness because it might be only a unilateral deafness, at any rate in the early stages. Neither the patient nor the doctor who first saw him might appreciate the degree of deafness present when there was a relatively normal ear on one side.

That brought him to the question about the use of the noise-box to exclude the good ear. He had noticed, as Mr. Cawthorne had done, that frequently when these hearing tests were employed by those who did not use the noise-box, wrong conclusions were drawn as to the degree of deafness in the affected ear.

The noise-box was the only means available at present for excluding the sound ear and thus enabling one to say whether the affected ear was completely deaf or not.

Mr. GAVIN LIVINGSTONE said that in America he had recently seen an interesting masking machine which was used in place of the noise-box. The volume was controlled in decibels, and the device was of great practical value.

Dr. T. O. HOWIE (in reply) said that with regard to the caloric test for the horizontal canal, it was probably merely laziness that prevented otologists going forward with that. In the old days it was customary to make the patient sick by changing the position and

stimulating the vertical and horizontal canal in rapid succession, when massive douching was employed.

Mr. Davis had said that the rotation tests were not much used. He quite agreed that if some of the time taken in the examination of these cases could be cut down it would be very valuable. Sometimes they occupied too long a time, and he had hoped that some suggestions might be forthcoming in the discussion as to the parts of the test which were unnecessary and that it might be crystallized down to a useful clinical test, enabling the otologist to deal with patients in a shorter time.

Mr. Cawthorne had spoken about nystagmus in the 8th nerve tumours as being the result, not of irritation of the nerve trunk, but of the secondary irritation in the pontine angle. That again accorded with what was seen in cases examined by him. Nystagmus had become cerebellar or sub-tentorial in origin. He was glad that Mr. Cawthorne had stressed the point that the otologist sometimes missed these cases. At an earlier period Cushing had said the same thing, and he did not think that even now otologists were free from blame. One often found that the cases which came forward with these tumours had been under treatment for deafness elsewhere, or perhaps in one's own clinic. With regard to intra- and extra-cerebellar cases, one point that Nylén made very strongly was that any case showing vertical nystagmus was probably inoperable.

He had been asked about the duration of the syringing. Syringing with cold water took three or four seconds, done steadily, and as long as one did it regularly in that way one had a standard to work on.

Mr. Thacker Neville had mentioned the rotation test and the out-of-door walking test. He himself had been very much impressed with the results of testing these patients walking with their eyes shut. In the old days they were made to walk on straight lines and so on, and the patient who had been accustomed to overcome vertigo or unsteadiness could walk on straight lines quite well; whereas, if he was made to shut his eyes, deviations would be found occurring often 2 to 3 feet in 6 yards. He had always thought the procedure of rubbing the ear was a lazy way of using the noise-box, applying it himself at the bedside.

Mr. Simson Hall had spoken of the pointing test. He had not used it and it did not enter into Nylén's description.

He thanked Professor Dohlman for his interesting contribution. Professor Dohlman was one of the scientists to whom otologists looked for help in reducing the time of examination instead of giving them more difficult methods. He had also to thank Dr. Proetz; he was glad that Dr. Proetz felt that localization was not good yet, even in America, and that something more was required to bring it to the desired standard.

A Fatal Case of Otitic Cerebellar Abscess with Contralateral Petrositis

By W. Stirk Adams, F.R.C.S.

The patient was a woman aged 22.

History.—During an attack of scarlet fever at the age of 8 years, left otitis media developed and discharge persisted for the next four years. During the following two years the ear was dry, but after that time the discharge recurred and persisted for a further eight years. At the age of 13 the patient was examined by an otologist, and at the age of 14 by a second otologist; neither advised operation. In 1932, when aged 19, she became conscious of a constant ache at the back of the left ear, and a left-sided headache. She also noticed some weakness of the left side of the face, but after three months' electrical treatment of the facial muscles considerable improvement occurred. Some weakness, however, persisted.

In November 1932 a left radical mastoid operation, with skin-graft, was performed. During the post-operative period a right-sided quinsy developed and required incision,

but apart from this her progress was satisfactory until seven weeks after the mastoid operation. Vomiting and vertigo then developed, and two hours later the patient became unconscious. She was then found to be suffering from meningitis, and a cerebellar abscess was suspected, though a cross-bow cerebellar exposure at this time failed to reveal it. The left temporal lobe was independently explored through a left temporal trephine, but again no abscess was found. Fourteen lumbar punctures were performed and gradual improvement resulted. Nine months later the patient returned to her business, apparently cured. For a year she remained well and actively employed, but in August 1934 an attack of vomiting and vertigo, associated with headache, occurred quite suddenly and lasted for five days. This attack was followed by unsteadiness in her gait: this gradually lessened but she never really felt secure in walking. A second and more severe attack of vomiting and vertigo occurred three weeks later, and lasted for a week. After this she noticed weakness in her left hand; she felt that she could not hold objects properly in that hand and could not control them. Weakness was also present in the left leg but to a lesser degree. Five attacks in all occurred between August and October 1934, in which month she was admitted to the General Hospital, Birmingham, under the care of my colleague, Dr. Bulmer. She was then fully conscious and although slightly lethargic, gave normal replies to questions. The symptoms pointed strongly towards a cerebellar lesion, and neurological examination suggested a chronic abscess in the left half of the cerebellum as the probable cause. We regarded the attacks of vomiting and vertigo as due to increased intracranial pressure, because their occurrence was associated with tenseness of the dura in the left temporal trephine opening. The left mastoid cavity had been discharging continuously since the operation of two years before but she told us that the discharge ceased immediately before an attack of vomiting and, as the attack subsided, became profuse. A cerebellar abscess leaking into the mastoid cavity seemed a possibility, though a search for a track, by filling the cavity with lipiodol, was unsuccessful.

Blood-count (October 29, 1934): Leucocytes, 15,120. *Differential:* Lymphos. 33·2%; transitional and hyalines, 3·0%; polys. 62·0%; eosinos. 1·6%; mast cells, 0·2%.

Cerebrospinal fluid (October 23, 1934): Under an initial pressure of 110/120; clear and colourless. Cells 1·25 per c.mm. Sugar content, 51 mgm.; sodium chloride, 750 mgm.; protein, 120 mgm.; globulin positive; Lange: 3334432000.

On November 6, 1934, the cerebellum was exposed through a cross-bow incision by my colleague Mr. Alan Stammers. A considerable number of adhesions were discovered but no abscess was found. After this it appeared clear that any cerebellar lesion was likely to be in close association with the temporal bone, and to be either an abscess at the front of the cerebellum or, more likely, an encysted collection of serous fluid in the lateral cistern. To expose this I felt it wise to reopen the radical mastoid cavity and expose the cerebellar dura, especially in view of the fact that there had been increased discharge from the mastoid cavity after the attacks of vertigo.

On December 15, 1934, exposure of the mastoid showed that the previous operation had been confined to the region immediately around the mastoid antrum. A wide mastoid removal was then undertaken, following all tracks to their termination. Dense secondary sclerosis was encountered throughout and two main tracks were discovered: (1) Towards the tip of the mastoid in the retrofacial gutter; at the bottom of this a small sequestrum was found, while immediately beyond, there was a small abscess in the digastric fossa in the neck. (2) In the petrous angle a series of unopened cells were dealt with, one of which also contained a sequestrum.

The operation was completed by widely exposing the lateral sinus and cerebral and cerebellar dura mater. No track leading to an extradural collection was discovered, and there was no perforation through the dura. Owing to the extreme hardness of the bone, two hours had then passed and the operation was suspended.

A week later the search for the track of infection was continued, the mastoid incision being reopened and the bone exposure continued forward over the attic. The posterior part of the tympanic plate was thinned down and the petrous apex then explored by the drill, following the Almour technique. The drill entered the apex at approximately 6 mm.; no collection of exudate was present.

On December 30 the cerebellum was again needled through the occipital incision but, as before, no abscess was found.

Towards the end of the illness a right paracentesis was performed; the date is not recorded in the notes but it was probably about six weeks before death, which occurred on January 25, 1935.

Post-mortem report (January 25, 1935): "Pathological summary: Multiple cerebellar abscesses; suppurative meningitis; internal hydrocephalus: suppurative mastoiditis. The body of a young, well-developed woman with an incompletely healed mastoid scar on the left side and scalp incision in the occipital region, where a cerebellar decompression had been performed.

Skull: Bony occipital defect at site of previous decompression. Small perforation present on anterior portion of left petrous bone representing site of origin of cerebellar infection from left middle ear. Both petrous bones removed *en masse* for detailed examination.

Brain: Much flattening of convolutions of both cerebellar hemispheres. The left cerebellar hemisphere was extremely adherent to the adjacent meninges and bone; it proved impossible to separate them. During removal of the brain thick pus exuded from the left cerebellar hemisphere. The substance of both lobes of the cerebellum consisted of necrotic diffluent mass the most part of which disintegrated during removal of the brain. Incisions into the left lobe of the cerebellum revealed numerous small multiloculated abscesses containing thick pus. There was no evidence of abscess formation in the right cerebellar hemisphere and presumably the pus which escaped from that side in removing the brain had tracked over from the opposite side. There was considerable dilatation of both lateral and 3rd ventricles.

Chest: Heart normal, apart from some pallor of myocardium and the presence of ante-mortem clot in right auricle. Great vessels normal; no evidence of embolism. Lungs and pleuræ normal.

Abdomen: All abdominal contents normal."

Examination of the Temporal Bones (*E. W. Peet, F.R.C.S.*)

(*Ferens Institute of Otology, Middlesex Hospital*)

The temporal bones were fixed in 10% formal saline, decalcified in 1% nitric acid and embedded in celloidin. Serial sections were cut in the horizontal plane.

Right ear.—There is a perforation in the postero-inferior part of the tympanic membrane. The mucoperiosteum of the middle ear is thickened by recent inflammatory infiltration. The ossicles are covered by young exuberant granulations. The middle-ear cavity, mastoid antrum, and mastoid cells are filled with purulent exudate.

The apical portion of the petrous is occupied by a large abscess. This abscess has evidently arisen by spread of the middle-ear suppuration along a track of cells extending forwards, medial to the posterior semicircular canal. Serial sections do not show any evidence of origin of this abscess by the anterior peritubal route. There is no involvement of the meninges in the inflammatory process.

The cochlea and vestibule show a mild degree of serous labyrinthitis.

Left ear.—There are chronic suppurative changes in the middle ear, the appearances being complicated by previous operative interference, the membrane, malleus, and incus having been removed. The crura of the stapes have been destroyed by the disease process and the stapedius muscle is completely atrophied.

The facial canal has been eroded in two situations, (*a*) on the tympanic side of the geniculate ganglion, and (*b*) in the stapes region, where there is a degree of perineural fibrosis. The remains of the mastoid-cell system contain a partially organized exudate.

The dura mater is thickened over the inner aspect of the petrous.

In the neighbourhood of the internal auditory meatus and opposite Trautman's area there is a recent extradural abscess. In these situations there are areas of necrosis in the dura.

It is probable that the cerebellar abscess arose by direct extension through Trautman's space.

Commentary.—In this case there are many points of interest worthy of attention :—

(1) I think we must agree that the mastoid exploration should have been carried out soon after the onset of discharge at the age of 8 years : the risk of persistent otitis and intracranial complication would thus have been abolished.

(2) The left facial weakness suggested that the infection might have tracked along the left facial canal. The specimen shows that it had not done so, although an erosion into the facial canal accounts for the paresis.

(3) It appears to me that the intracranial complication followed the first radical mastoid operation in December 1932. At the time it was diagnosed as a cerebellar abscess, but as no abscess was found on exploration, an intradural infection from the region of the mastoid was considered most probable. In spite of the patient's recovery from symptoms for twelve months it is possible that a latent cerebellar abscess was present during this period. When she first came under my observation in October 1934 a left cerebellar abscess was again regarded as the most likely diagnosis, but no abscess was discovered at operation so we were driven to the conclusion that a leaking infection from the mastoid was producing a meningeal irritation in the left cerebello-pontine angle region, and for this reason the petrous apex was explored. The discovery of petrositis on the right side was a complete surprise, because when examined in October 1934 the right tympanic membrane was normal and the hearing was unaffected. The patient's lethargy and slow physical deterioration during the last three months of life must explain the silent march of events in the right mastoid, following an otitis media which had given no cause for concern. The pus found over the right side of the cerebellum was probably the result of a leak from the right mastoid and not, as we thought at the time, a spill-over from the opened cerebellar abscess on the left side.

(4) Macroscopically, an erosion was seen on the anterior surface of the left petrous apex. At the time it was thought this was probably the track through which the infection had reached the left cerebellum. I now think this unlikely, and regard an infection in the cells of Trautman's triangle as its most likely origin.

Section of the History of Medicine

President—A. P. CAWADIAS, O.B.E., M.D.

[*May* 4, 1938]

Notes on Dr. Thomas Goulard's "Treatise on the Effects and Various Preparations of Lead—particularly of the Extract of Saturn—for different Chirurgical Disorders"

By J. H. THOMPSON, M.B.

THOMAS GOULARD was born at Saint-Nicholas-de-la-Grave, near Montanbare (date unknown). He was demonstrator of anatomy and surgery, and later chirurgien-major, at the Military Hospital at Montpellier. He was professor of surgery from —— to 1784 at Montpellier. He compounded "eau blanche", a mixture which contained, chiefly, lead oxyacetate and which is still included in the French Pharmacopœia. In 1766 he published his *Treatise on Lead*, and the same year a work on venereal disease with a special part devoted to maladies of the urethra including enlarged prostate. The *Treatise on Lead* was translated into English by an unknown writer, in 1773.

The *Treatise* opens with an introduction in which the author briefly sets out the many uses to which lead can be put in the cure of disease and the great advantages from its administration. He points out in the opening lines, what was perfectly true at that period, that

"it is to Chance alone we are indebted for the major part of the remedies now successfully made use of in Surgery and Physic" and cites the "discovery of the peculiar qualities of Bark and Mercury as being more the effect of Chance than Erudition".

No remedy, he thinks, deserves a higher rank than lead, whose general virtues, as well as preparations, he admits have been known for many years past, although "it is a subject of no small surprise that the disuse of it should be so great". He even finds "eulogiums" bestowed on this metal in Galen's tenth book on Simple Medicines. Therefore he says:—

"I by no means pretend to publish this composition of the Extract of Lead as any new discovery of my own; my only intent, in this treatise, is to lay before the masters of the art and the public, the various forms I have given this extract, and the particular cases in which it has been specific, to the no small astonishment of the Faculty."

He became convinced by his own experience and observation, in the course of many years' practice, that the Extract of Saturn was much wanted in surgery. He says:—

"The many different forms I have given this medicine render it very proper for a variety of external complaints."

He even goes further and thinks that it might be employed in small doses internally, after having been deprived of its noxious qualities, but in this treatise his "design is only to show its good effects in external complaints".

Then follows a list of the modifications he gives to the make-up of the drug and the different diseases to which it may be applied.

The use of lead was by no means a novelty. The metal was known to the ancients and is mentioned six times in the Old Testament, though never as a drug. The

Romans used it largely, as it is still used, for the making of water-pipes. It was familiar to the alchemists, who designated it by the sign of Saturn (♄). It was extensively used in medicine for various external purposes before Goulard's time. Goulard thus gives this formula for " Composition of the Extract of Saturn ",

" Take as many pounds of litharge of Gold[1] as quarts of wine vinegar (if made of French wine the better) ; put them together into a glazed earthen pipkin, and let them boil, or rather simmer, for an hour, or an hour and a quarter, taking care to stir them during the ebullition with a wooden spatula ; take the vessel off the fire, let the whole settle, and then pour off the liquor which is upon the top into bottles for use.

" I shall call this liquor the Extract of Saturn, which is to undergo a further modification as I shall direct."

If it is intended to give this liquor the common consistence of an extract it must be boiled some time longer, when it will become thicker and of a reddish colour.

He further speaks of a Water of Saturn which he says

" is nothing but ceruse, thrown into a matrass, into which is poured distilled vinegar and digested in hot sand ". This Water of Saturn is different from the Extract and its effects must necessarily be less powerful and extensive.

It is with the Extract, however, that he composes various topical remedies, giving it the preference to all others, for the treatment of almost all chirurgical disorders. Then comes a circumstantial account of the various formulæ, and after describing each of the formulæ he specifies the disorders to which it is applicable.

First he deals with the Water of Saturn or, as he calls it, vegeto-mineral water. It is made by putting two teaspoonfuls—or 100 drops—of the Extract of Saturn to a quart of water and four teaspoonfuls of brandy. The quantity of the extract and brandy may be diminished or increased according to the nature of the disorder or the greater or less degree of sensibility of the part grieved. This preparation is akin to our well-known lead and spirit lotion.

(1) It is a well-known specific, he says, against all external inflammations, and particularly against those of the eye.

(2) Against fluxions of the membrane of the tympanum and occasional deafness. Camphorated brandy should here be used instead of common brandy.

(3) For the cleansing of wounds.

(4) By way of fomentation, after any chirurgical operation and for pains in the side.

(5) For washing old callous foul ulcers, also ulcerated and occult cancers ; against contusions and bruises ; against extravasation of blood or ecchymoses ; against thrombus, proceeding from phlebotomy ; against inflammations of the tendons, ligaments, and aponeurosis ; against phlegmons and abscesses, whether in their commencement or after ; against sprains ; against excoriations ; against burns ; against the king's evil ; against inflammations caused by gunshot wounds ; against fistulous sinuses ; against fistulas, whether of the eye or anus or others ; against inflammations and curdlings of the milk in the breasts, abscesses and ulcers of those parts ; against the erysipelas ; against the piles ; against chilblains ; against ankylosis ; against a contraction of the tendon ; against tumours and inflammations attending luxations and fractures ; against whitlows ; against tetters ; against itch ; against ruptures with strangulation ; against a gangrene, or wounds that threaten one.

Chapter I deals with external inflammations, and of the action of the Extract of Saturn on these disorders. Although Goulard's ætiology and pathology are not in every case such as we now accept, they are worth recording. He says that an external

[1] Litharge of Gold, evidently refers to an impure mineral containing gold and lead, as well as tin and tellurium, known as nagyagiti and coming from Nagyag in Transylvania. The word litharge is now used to mean the semi-vitrified oxide of lead separated from silver in refining.

inflammation may follow a blow, a fall, a contusion from external accident. Internally it may follow some local defect of the " solids ", the contraction of the smaller vessels or from their spasm, compression, constriction or obstruction ; from the difficulty which the blood finds in passing the extremity of the arteries ; from its too great quantity, thickness, viscidity, mixture with heterogeneous and virulent parts ; or from any other alteration, whether simple or combined.

After observations made during twenty years' practice he is convinced that the Extract of Saturn is the true specific for the treatment of all external inflammations. Its effect is infallible and often surpasses our expectations. Owing to the ebullition of the litharge with vinegar, he holds that the leaden particles are suspended in the liquid, and that these particles are so formed, as to be capable of entering the pores of the skin, and the orifices of the smallest vessels. Upon these they act by their weight and volume, and so disperse the humours which " choke " the inflamed vessels, augment their motion, and bring them back to the course of circulation. While extolling the excellent qualities and results of this extract he says " he cannot too much exclaim against the practice of those who employ emollient and relaxing fomentations in the treatment of such cases. A surgeon of some degree of reputation consumed so great a quantity of mallows and other emollient plants in a campaign of only three months, that he exhausted the whole country where the French Army was encamped, and worse still his treatment resulted in the production of worms in almost all the gunshot wounds.

He mentions erysipelas, or St. Anthony's fire, among the different inflammations that fell within his practice, and remarks that this disease is often advanced " by the remedies commonly made use of to subdue it ", while it is subdued in almost all cases by the Extract of Saturn. Boils, carbuncles and whitlows, inflamed glands and quinsy he claims are all benefited by the same application, though it is interesting to note that a man of his experience should state that he has no opportunity of applying his remedy in the case of carbuncle.

Even in this age of many new preparations few will dispute the benefit of an evaporating lead lotion for contusions, but think of the added dignity it would assume if we called it vegeto-mineral water !

Goulard's description of burns bears analysis even in the light of modern knowledge. For burns of a more superficial nature he applied the vegeto-mineral water compresses and kept it constantly moistened. If the burn was of a deeper nature he used little pieces of fine lint covered with lead ointment and covered the whole with compresses dipped in the vegeto-mineral water, and moistened from time to time.

For ulcers of the leg he finds that the Extract of Saturn, either as a wash or in the form of an ointment, alleviates the pain, favours their suppuration, renders fluid the stagnant humours in the obstructed vessel, and quickly brings the most obstinate ulcers to cicatrize.

Some of Goulard's pathological views are those still occasionally heard from the uneducated, for example that certain " ulcers are looked upon as drains, by which the blood is purified, and which give rise when attempted to be cured to a reflux of vicious matter into the mass, the consequence of which is much more to be dreaded than the ulcer itself ". This unfortunate result however does not follow if the ulcer is treated by lead. Even cancer, which in those days remained untreated and consequently often broke down and ulcerated, he found much relieved by frequently repeated dressing with vegeto-mineral water. Sprains and subluxations and gouty and rheumatic pains are also cured or relieved by the same methods.

After extolling the advantages of lead in these and other conditions, he concludes by asserting that there is not to be found, among all the chirurgical preparations, a medicine more adapted than Extract of Saturn, for subduing external inflammations; that it is endowed with the singular property of penetrating the obstructed blood

and lymphatic vessels and of dispersing the inspissated matter therein, without too much relaxing or irritating the coats of the inflamed parts. (An interesting sidelight on the pathology of the day.)

This remedy seems to unite at once three qualities, very essential for an anti-phlogistic medicine :—

(1) A cooling virtue, which the most ardent inflammatory heat cannot resist.

(2) An anodyne one, which quiets the most violent pains observed in inflammation.

(3) An attenuating resolving quality, which the prejudiced part of mankind has unfairly confounded with repulsion ; in short—all the parts of the body, without distinction, fatty, glandulous, muscular, tendinous, aponeurotic, membranous, ligamentous, weak or strong in their texture, endowed with greater or less degree of sensibility, bear equally the action of our metallic remedy.

The use of lead as a gargle is mentioned in two cases of inflammation of the " kernels " of the neck. The context leaves no doubt that inflamed tonsils are here implied. Bee stings, he observes, can be successfully treated by lead lotion.

Then follows a somewhat lengthy account of " Tetters " and the beneficial effects of lead in its treatment. Tetters seems to have been a sort of rubbish-heap of various skin affections. The term is used frequently in literature. Shakespeare uses it in Hamlet (Act I, Sc. 5).

> " And a most instant tetter bark'd about
> Most lazar-like, with vile and loathsome crust
> All my smooth body."

Also in Coriolanus (Act III, Sc. 1).

> " to infect with tetter, scab and scurf."

Again, Milton uses the word in one of his fiery outbursts :—

> " What a universal tetter of impurity had envenomed every part, order and degree of the Church."

Then we have the word occurring in certain other forms, as " tetter-berry " (the common bryony), variously used to cure and prevent tetter ; " tetter-worm ", a term used for a cutaneous affection, really a form of ringworm, and lastly " tetter-wort " (the common celandine), so named because it was supposed to cure tetters.

The term was thus used to cover a varied collection of skin affections, many supposed to be incurable. Goulard is, however, convinced that he has in lead a remedy which he proclaims as specific, " by the metallic particles insinuating themselves into the most minute pores of the skin, and penetrating to the only source which produced the tetterous complaint. When arrived there they thin and divide the humour, blunt its acrimony, favour its egress through the pores of the skin, and at last radically cure the disease, sooner or later ". He enjoins that certain preliminary preparations should be used, consisting of " bleedings, purgings, domestic baths, herb-broths and mineral waters ". As we might expect, considering the state of knowledge of these and other complaints at that time, the variety of external applications extolled in the treatment of tetters " was infinite ", but Dr. Goulard " is not afraid to assert that many are useless and others dangerous ".

Itch is another skin affection to which Goulard devotes a whole chapter. Up to this time few had carefully examined the burrow or " run " of the itch mite in this disease and hence the acarus was only vaguely recognized as related to the disease. Goulard divides itch into two kinds, the dry or " canine " and the moist or " great " itch. These are obviously only degrees of the same condition. The distribution he describes quite accurately " as an eruption of little cutaneous pustules, which may be indiscriminately spread over the whole body, except the face ; but is more particularly remarkable on the wrists, between the fingers, on the arms, hams, and thighs ". He refers to itch as being endemic in Brittany, where " a number of people retain, during their whole lives, the leaven of this disorder ".

He states that " the only two specifics for the itch hitherto recommended, are

sulphur and mercury". Mercury he dismisses as a heating and searching remedy, while sulphur is "neither so agreeable nor convenient a medicine as one could wish". Lead, however, he maintains, has every advantage over the other two, and is so inoffensive that no exception can be taken to its use. To these considerations he adds another, that of expense, which seems to have been suggested because of the prevalence of the disease in the Military Hospitals. This is especially so "if it is considered that the linen of the soldiers does not suffer so much by the use of our medicine, which will be no inconsiderable saving". To show how pleased the military authorities were with the treatment of the itch by lead, Dr. Goulard gives in full certain observations made by order of the Minister, in the hospitals of Arras and Bethune, where more than 2,000 soldiers were treated by Extract of Saturn.

The last two conditions which Dr. Goulard mentions are ruptures and piles, and again it will be noticed that he does not once give the more scientific names. It is, of course, in cases of strangulated hernia that he uses, with some degree of reason, his evaporating lotion, hoping thereby so to constrict the vessels and reduce the swelling that the strangulated coil of bowel will slip back into the abdomen.

Australian Convict Doctors

By J. Burton Cleland, M.D.

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There is, perhaps, no more fitting introduction to the subject of convict doctors than Sydney Smith's famous remarks on different degrees and species of guilt in the course of his essay on "Botany Bay" in the *Edinburgh Review* for 1823 ("The Works of the Rev. Sydney Smith", vol. II, p. 15, London, 1859).

"Men are governed by words; and under the infamous term *convict* are comprehended crimes of the most different degrees and species of guilt. One man is transported for stealing three hams and a pot of sausages; and in the next berth to him on the transport is a young surgeon, who has been engaged in the mutiny at the Nore; the third man is for extorting money; the fourth was in a respectable situation in life at the time of the Irish Rebellion, and was so ill read in history as to imagine that Ireland had been ill-treated by England, and so bad a reasoner as to suppose that nine Catholics ought not to pay tithes to one Protestant. Then comes a man who sets his house on fire, to cheat the Phœnix office; and, lastly, that most glaring of all human villains, a poacher, driven from Europe, wife and child, by thirty lords of manors, at Quarter Sessions, for killing a partridge. Now, all these are crimes, no doubt—particularly the last; but they are surely crimes of very different degrees of intensity to which different degrees of contempt and horror are attached—and from which those who have committed them may, by subsequent morality, emancipate themselves, with different degrees of difficulty, and with more or less of success. A warrant granted by a reformed bacon-stealer would be absurd; but there is hardly any reason why a foolish hot-brained young blockhead, who chose to favour the mutineers at the Nore when he was sixteen years of age, may not make a very loyal subject, and a very respectable and respected magistrate, when he is forty years of age, and has cast his Jacobine teeth, and fallen into the practical jobbing and loyal baseness which so commonly develops about that period of life. . . . Dr. Redfern, surgeon, seems to use the public rhubarb for his private practice. . . . It is seldom, we suspect, that absolute dunces go to the Bay, but commonly men of active minds, and considerable talents in their various lines—who have not learnt, indeed, the art of self-discipline and control, but who are sent to learn it in the bitter school of adversity. . . . Botany Bay . . . was colonized, not to gratify the insolence of Pharisees, but to heal the contrite spirit of repentant sinners. . . . The most resolute and inflexible persons in the rejection of pardoned convicts were some of the marching regiments stationed at Botany Bay—men, of course, who had uniformly shunned, in the Old World, the society of gamesters, prostitutes, drunkards, and blasphemers—who had ruined no tailors, corrupted no wives, and had entitled themselves, by a long course of solemnity and decorum, to indulge in all the insolence of purity and virtue."

Sydney Smith's masterly analysis of different degrees and species of guilt amongst those sent as convicts to Botany Bay leaves little more to be said on this aspect.

It is probable that most of the out-and-out ruffians, cold-blooded murderers, and so on, received the death-penalty, and thus their tainting influence has played little part in the make-up of the early colonial population. Doubtless a lot of clever rascals escaped the gallows and received sentences of transportation instead. One such was that pettifogging lawyer, afterwards a prominent citizen in Sydney, who was mixed up in the disputed will case in which a live fly had been placed in the dead man's mouth, so that the witnesses could swear there was " life in the man " when the signing was done. George Barrington, afterwards a very successful Superintendent of Convicts, the supposed author of the lines—

> " True patriots all, for be it understood,
> We left our country for our country's good ",

was probably more a rascal by accidental circumstance than from malice aforethought. Our own profession does not lend itself to incorporation in its ranks of criminals of the baser sort. It is true we have had murderers and abortionists and men guilty of sexual offences, but I refer to men of low and thoroughly bad character. Of the five medical men transported to Sydney of whom I have notes, there is nothing to show that any one of them was vicious—in fact, as will be seen, in several instances they were men of probity and uprightness.

Strange to say, the first convict emancipated, John Irving, was a medical man. Governor Phillip, in a despatch to the Rt. Hon. W. W. Grenville, dated July 14, 1790, states that he was emancipated for his meritorious behaviour and had been sent to Norfolk Island to act under the Surgeon. He adds : " This man was bred to surgery, and will, I hope, be thought to merit the moiety of an assistant surgeon's appointment from the time of his emancipation—the 28th of February 1790." He is referred to again by Phillip on November 5, 1791, and it is stated that he was acting as an assistant to the surgeons, who found him a very useful man, and that he was inclined to stay in the country. A formal warrant for his emancipation was granted him by Phillip on December 16, 1791, the seal of the territory having reached Sydney on September 21, 1791. Lieut.-Col. Collins, in the *Colony of New South Wales*, says that Irving was " one of those persons whose exemplary conduct and meritorious behaviour, both in this country and in the passage to it, had been rewarded with unconditional freedom by the Governor ". His name appears in a return of settlers, dated October 8, 1792, as an " emancipated convict, acting assistant surgeon ". Irving (Hunter calls him Irvine) died on September 5, 1795, two days before Governor Hunter's arrival.

Daniel MacCallum, a surgeon, was pardoned on July 18, 1801, to enable him to practise his profession. On the instructions of Governor King, dated November 22, 1802, he accompanied Acting Lieut. Robbins to Bass Sts., to let the French think that this part was going to be settled and so counteract any attempt on their part to establish a settlement in the eastern part of Australia.

Bryan O'Connor, a physician, transported with those concerned in the Irish Rebellion of 1800, was emancipated on August 12, 1801, in order that he might practise his profession. The category to which he belongs is wittily defined by Sydney Smith.

Having disposed of these lesser folk, we have two important persons to consider—Dr. William Redfern and Dr. William Bland.

Dr. William Redfern

William Redfern was transported for complicity in the mutiny at the Nore, and is specially referred to by Sydney Smith. As Professor G. A. Wood has put it, he eventually became

> " the best doctor in Sydney, with an excellent reputation for humanity and good citizenship, a big and successful farmer and a man of high intellectual ability ".

Mr. Commissioner Bigge, in the course of his inquiries in Australia, states that he learned from Mr. Redfern himself that he had been sentenced to death by a Naval

Court Martial for being implicated in the mutiny at the Nore in the year 1797, and that the nature of his offence consisted in having verbally advised the leaders of the mutiny to be more united among themselves. He was at that time 19 years of age and had served for a few months as Surgeon's First Mate on board H.M.S. "Standard". In consideration of his youth, his life was spared, the sentence being commuted to transportation for life. Mr. Commissioner Bigge goes on to say that

"On his arrival in N.S.W. Mr. Redfern was sent to Norfolk Island, where he got, as Assistant Surgeon, on the civil establishment and was appointed in 1802 by Lieut.-Col. Fovaux to act as Surgeon there. In that year he also received from Governor King an absolute pardon and his name appears in the Sydney Gazette of 19 June 1803 among those upon whom that Act of Grace had been conferred. In the year 1804 Mr. Redfern was relieved by Mr. Wentworth, but he continued to assist him and Mr. Conollan until the month of May, 1808, when he accepted the situation of Assistant Surgeon in Sydney under a local commission conferred upon him by Lieut.-Col. Fovaux, which upon the strong recommendation made by that officer to Governor Macquarie on his arrival, was submitted to the consideration of His Majesty's government and finally sanctioned by H.R.H. the Prince Regent, and announced to the public in the Sydney Gazette of 1st February 1812."

Bigge, in his Report, devotes most of six pages to Redfern and gives the reasons why he considered that he should not have been elevated to the magistracy by Macquarie. Amongst these is an inference, apparently more or less established, that Redfern used drugs and medical supplies, purchased by Government and mostly intended for the use of convicts and the establishment, for his private patients, without paying for them or replacing them. Another was that he had used unjustifiable severity in punishing his apprentice, Mr. Henry Cowper, and in treating one of his convict servants. It appears that Mr. Commissioner Bigge travelled in Australia with Mr. Bowman, who was later appointed Principal Surgeon. William Charles Wentworth, in the third edition of his work, *A Statistical Account of the British Settlements in Australasia*, published in 1824, suggests that Bowman influenced Bigge's mind in his own favour and against the claims of Redfern to be appointed Principal Medical Officer. Wentworth states that Redfern, very soon after Commissioner Bigge's arrival, became the object of his personal and rancorous hostility

"in consequence of a slight which Mr. Redfern offered to him in his inquisitorial capacity, by contemptuously declining to produce certain papers which Mr. Bigge haughtily demanded, as well as to answer certain interrogatories which Mr. Bigge put to him touching some early incidents in his life—incidents which were wholly disconnected with the object of Mr. Bigge's enquiry."

Wentworth then goes fully into the question of Bigge's treatment of Redfern, very much to the disadvantage of Mr. Commissioner Bigge. There seems every reason to think that Wentworth's view was probably the correct one. Redfern was highly thought of by Governor Macquarie, and was frequently invited to his table. On the other hand, the junior officers of the 46th Regiment (apparently a most objectionable set of young men) refused to sit at table with him on account of his having been an emancipist, though, as Professor G. A. Wood points out, he was a man of culture and humanity far superior to their own. He died in Edinburgh on July 23, 1833, at the age of 55, and was buried in the New Calton Burying Ground.

Dr. William Bland

William Bland, M.R.C.S., was born in London, November 5, 1789, and was the son of a distinguished medical man. He went to the Merchant Taylors' School and obtained his membership of the Royal College of Surgeons when barely 21, and then received an appointment in the Royal Navy. On his way to India in medical charge of the ship, he quarrelled with the purser and a duel took place in which the latter was fatally wounded. As the result of an insinuation of unfairness on the part of Lieutenant Randall, who was Bland's opponent's second, another duel took place in which neither principal was wounded. On arrival at Calcutta Bland was arrested and condemned to seven years' transportation. On arrival in New South Wales in

1814 Governor Macquarie gave him his liberty immediately on landing and allowed him to commence practice, a formal pardon coming from the Home Authorities soon afterwards. He became Secretary to the Australian Patriotic Association in 1835, and was elected to the Legislative Council at the first election following the granting of the Constitution in 1842, together with William Charles Wentworth; Bland received 1,261 votes and Wentworth 1,275. He was unseated in the second election in 1848, when Wentworth received 1,188 votes, Lowe, afterwards Viscount Sherborne, 1,012, Lamb 950, and Bland 874.

When the bill for establishing the University of Sydney was being discussed in the Legislative Council, Robert Lowe, probably speaking in general terms, said that no one who was an ex-convict should be eligible as a member of the Senate. Bland thought that this remark was aimed particularly at himself and straightway wrote the following very insulting but doubtless characteristic letter to Lowe :—

> "Oct. 11, 1849.
>
> Sir,
>
> I have this moment read the report of your speech of yesterday evg. in the *Sydney Morning Herald* of to-day, and I feel no doubt that you have used your position in the Council to vent your private malignity against me. I am, however, recommended not to call upon you for the satisfaction of a gentleman,—because you have on more occasions than one (where the claim for reparation from the nature of the insult was even stronger than in this case) in a manner the most cowardly evaded it. I shall therefore content myself on this occasion with merely expressing my opinion that you are a coward and a scoundrel; but which opinion I shall be happy to retract if it is in your nature to give me an opportunity.
>
> I am, Sir,
>
> Your most obedient Svt.,
>
> W. BLAND."

He lived in Pitt Street, Sydney, between 1837 and 1848. Near Hunter's Hill, 1¼ miles above the wharf, he purchased 30 acres of land which had been granted to George Fieldhouse. This, in 1866, was subdivided and named Blandville. His old red chariot (some writers speak of it as yellow; possibly the colour varied from time to time) was as well known in the old streets of Sydney as its owner. Only about twenty years ago I remember hearing someone speak in Sydney, at a meeting of the Royal Australian Historical Society, who had been ushered into the world by Dr. Bland. He could make a good repartee on occasion; he was attending Mr. Sam Terry, who said to him one day, "Doctor, I would give £10,000 to have your character and reputation". "Yes," grunted the doctor, "so that you could make £20,000 out of it!"

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JOINT DISCUSSION No. 6

Section of Psychiatry and Section of Neurology

Chairman—EDWIN GOODALL, C.B.E., M.D. (President of the Section of Psychiatry)

[*May* 10, 1938]

DISCUSSION ON THE PRESENILE DEMENTIAS: SYMPTOMATOLOGY, PATHOLOGY, AND DIFFERENTIAL DIAGNOSIS

Dr. W. Mayer-Gross[1]: When a psychiatrist speaks about the symptomatology and differential diagnosis of presenile dementias, he ought perhaps to trace out a number of clinical types in which the underlying pathological process may be inferred from the diagnosis. I do not think this would be impossible, but the difficulties are certainly much greater than in many other fields of psychiatry. It seemed, therefore, more appropriate to discuss this evening these difficulties in diagnosis, in order to find out what we really know on the clinical side and where the gaps in our knowledge are.

I propose to discuss these difficulties under four headings: (1) Personality and constitution. (2) Temporal factors. (3) Spatial factors (localization). (4) Special groups and nature of the disease.

To start with a few definitions: The word "presenile" is used here as a purely temporal notion, to indicate a disease occurring between the ages of 40 and 60; it does not imply that the presenile diseases are really senile ones coming on at an earlier age than usual. Dementia means failure of intellectual and mnestic functions. For the interpretation of the symptoms it is important to consider the contrast between, on the one hand, personality—that is, the whole of the emotional and volitional functions of the patient—and his memory and intelligence on the other. It has been said that intelligence and memory are tools handled by the personality; but it is really more a matter of interaction; each influences the other and their interdependence becomes especially evident if one of them is disturbed by disease.

PERSONALITY AND CONSTITUTION

As the first factor which influences the clinical picture, the original personality of the patient has to be taken into account. Even in organic psychoses, the constitutional features may for a considerable time cover the clinical picture, especially when the specific symptoms of the illness are only negative (in Hughlings Jackson's sense). Bostroem has, for instance, published a series of cases of presbyophrenia in which he could demonstrate how much the original hyperthymic personality contributed to the patient's symptoms. His patients, mostly women, were lively, sociable, friendly, and alert. These character traits remained preserved in spite of enormous deterioration in memory and judgment which was, however, hidden behind

[1] With the support of the Rockefeller Foundation.

a good social façade, as happens so frequently in senility. Bostroem thinks that presbyophrenia arises only on such constitutional soil, a view which has been doubted, I think justifiably, by others. It is a common observation that failing intellectual control produced by presenile dementia often leads to an unveiling or an exaggeration of personality features. Striking changes in character or conduct, e.g. religious conversion, crises in married life, &c., in middle-aged people, may be the first premonitory sign of a presenile deterioration. Careful examination often reveals that these strange features are nothing really new, but have always been present, though latent. Diagnosis may be extremely difficult in cases of this kind, but merely to suspect a cerebral illness can often be helpful in the practical management of the case. The suspicion may be supported by the occurrence of early dementia among the near relatives.

Familial incidence of early senile deterioration is often observed, but it is doubtful if this is due to hereditary influence. Pick's and Jakob-Creutzfeld's diseases have been regarded as forms of heredo-degeneration. As one would expect, the number of cases confirmed by the pathologist is still much too small to make any definite statement about the question of heredity.

Temporal Factors

Among the temporal factors which influence the clinical picture of presenile dementia, one has to consider first the *phase of life* in which the dementia occurs. It is a common psychiatric observation that the melancholic or paranoid forms of psychoses occur with great frequency at the involutional or presenile period. No convincing explanation for this predilection can be offered. It needs, therefore, thorough and expert examination to decide the pathological nature of a depressive or paranoid illness occurring in a patient at this age, and even then, a definite conclusion may not be possible.

Cases of severe depression, with anxiety and restlessness leading to a gross deterioration, were classified by Kraepelin as one of his presenile groups. Grünthal (1935) has lately described pathological findings which he regards as characteristic in one of these patients, and proposed the name of "Kraepelin's disease" for this type. Similar cases of melancholia which became more and more stereotyped, shallow in affect, and finally demented, have been collected by Medow: he speaks of "involutional melancholia going rigid" ("erstarrende Rückbildungsdepression"). Depressive and paranoid symptoms with or without dementia occur in patients suffering from paralysis agitans, though neurologists are often naturally less concerned with these remarkable psychological accompaniments of the disorder. It is equally true of cases of atypical Huntington's chorea, and, of course, of the cerebral diseases of vascular origin, that they may be disguised by what one may call the psychotic symptoms of the involutional stage of life. I have deliberately omitted dementias following circulatory disturbance from this survey, because of scarcity of time. The psychiatric implications of these cases have been discussed in full lately (1937).

The concept of presenile dementia was originally introduced by Binswanger (1898) and was meant to characterize an early and rapid senility: the rapidity is, however, only relative. From two to three years' duration is usually given as a minimum, and as the material has accumulated, it has become obvious that even in Alzheimer's disease—which, if any, can be interpreted as a kind of early senility—cases may run a very prolonged course, lasting up to twenty years. Arrests and remissions have both been observed. Furthermore, one has to remember that the illness develops at a time of life in which normally the tempo of developmental changes is increased, as compared with the quieter periods before and afterwards. During this time psychoses of diverse origin are frequent. Combinations of endogenous, so-called functional, psychoses with presenile or senile cerebral processes can occur, and in such cases the contributing components may be disguised.

Localization

Although dementia is generally regarded as a global syndrome, the influence of cerebral localization on the clinical picture can scarcely be disputed in presenile patients. Just as in vascular cases with neurological symptoms, so here in parenchymatous degenerations like Pick's or Alzheimer's disease, focal distribution should be considered because of its considerable diagnostic value. In the initial stage of Pick's disease, for instance, patients with atrophy of the frontal lobe exhibit hilarious hyperactivity and lack of affective control. I remember one patient in whom a fondness for silly jokes was the first sign noticed by the relatives. He later became the good-natured clown and " butt " of the hospital ward. This is, of course, related to " Witzelsucht " seen in other affections of the orbital part of the frontal lobe. In Pick's disease it is usually followed by a stage of increasing apathy and loss of spontaneity, which is regarded as a sign that the convexity of the frontal lobe has been involved.

Grünthal observed two brothers of whom one was in this initial stage of silly hilarity at the time of his death; the other, who had passed through this stage earlier, died in a severely demented condition after a long illness. In the first patient a small lesion in the orbital region was found, in the second the shrinking extended to the convexity of both frontal poles.

Higher forms of reasoning are disturbed, whereas a simple, more automatic, form of intelligence remains relatively well preserved. If the atrophy takes place in the temporal lobe, a typical receptive aphasia often dominates the clinical picture. There may be logorrhœa with or without paraphasia.

One of my patients showed what I have described, in 1931, as "gramophone symptom" ("Spieluhrsymptom"); every time a physician or one of the staff came near him, he would repeat with correct expression and diction an elaborate anecdote, seeming himself highly amused by it, and could not be stopped until he had told the whole story. After a short interval he would repeat his anecdote as something quite new. There was nothing else one could get out of him. Understanding of speech was almost completely lost. An increased urge to talk, together with poverty of ideation and loss of retention, had produced the symptom.

Although in Alzheimer's disease the localized signs are mostly not so clear-cut, diffuse focal symptoms (" verwaschene Herdsymptome ") are regarded as diagnostically important. Aphasia, apraxia, and agnosia of various kinds are often vaguely present in the same case; they are not greatly pronounced and are submerged in a more global defect. One can, however, by careful investigation, sometimes analyse the single components of an apparently diffuse picture. I have described the complete setting of Gerstmann's pariteal syndrome, including constructional apraxia, in a patient observed in the Maudsley Hospital (1935), whose post-mortem examination revealed typical Alzheimer's disease. Post mortem Dr. Alfred Meyer found an accumulation of plaques in the left parietal region. Similar confirmation of focal signs by the discovery of an accumulation of parenchymatous changes in the respective regions has been described by other authors.

Much work has still to be done in order to elicit the real nature of the so-called diffuse focal symptoms. As other examples of clinical symptoms which cannot yet be correlated with local brain lesions, there are the logoclonic speech disturbances of many cases of Alzheimer, the motor symptoms such as stiffness and *marche à petit pas*, which are so characteristic of the later stages of the disease. It has, however, been possible for Kleist's pupils (Hertz and Fünfgeld) to connect the plucking movements of Alzheimer patients with lesions found in the caudate nucleus. There is the reverse instance, in which Martha Vogt has shown the degeneration of the cortical layers in Pick's disease, progressing in a fixed sequence, beginning with the lower 3rd layer, and leaving the 4th and 7th always unaffected. There has not been, as yet, a clinical application of these findings, but the possibility has to be borne in mind.

From a more general point of view one can say that Alzheimer's is a disease of the posterior parts of the hemispheres, Pick's of the anterior, and that this difference has its bearing on the symptoms.

It is easy to understand that in those patients in whom focal signs are less pronounced, factors of personality, constitution, or the predilection types of the involutional age, determine the clinical picture.

Furthermore, one has to allow for the fact that the cerebral diseases in question are of a rather slowly progressing kind ; one cannot expect that the undamaged part of the brain will react exactly as it does after a gunshot wound or an apoplectic hæmorrhage. Finally, the lesion takes place in a brain which no longer has the plasticity and adaptability of a younger age. All these are factors complicating the psychopathology of senile dementia.

Special Groups

With regard to the special groups and their symptomatology, I would like to emphasize that the presenile dementias include more than merely Alzheimer's and Pick's disease and Jakob-Creutzfeld's disease, and that there are many other cases which cannot be included under one of these headings.

Of the groups singled out by pathological findings, that of Pick's disease is very small. The condition occurs twice as frequently in females as in males. Among over 3,500 admissions to the Hospital Department of the Deutsche Forschungsanstalt für Psychiatrie, Munich, Schottky found 19 cases of presenile dementia of which only one proved to be Pick's disease. Its rarity was also recently emphasized by an American author whose observations covered post-mortem findings in several hundred elderly people. The first diagnosis made during life reported in the literature, as confirmed by the pathologist, was in Kahn's case (1924). Since in 1933, out of 19 cases confirmed post mortem, 11 had been clinically diagnosed (van Husen), recognition cannot be so difficult as some sceptical writers, like Davison, believe. There are, of course, atypical cases in which, for example, the atrophy does not extend to the orbital region, and therefore the initial hyperkinetic and jocular stage is missed (Schmitz and Meyer), or others in which the atrophy is situated in the parietal lobe only (Lhermitte et Trelles). On the other hand, only few people can gain experience of so rare an illness.

Alzheimer's disease is much more common. During the last one and a half years seven brains of patients who suffered from this condition have been collected in the Central Pathological Laboratory of the L.C.C. Mental Hospitals. This represents only a fraction of the post-mortem material of the L.C.C. Hospitals. Several of these cases had been diagnosed clinically. As the pathologist has difficulty in differentiating it from simple senile dementia, so has the clinician from cerebral arteriosclerosis. The distinction may be especially hard in the first stage, when defects of memory and retention, neglect of personal appearance, poor working capacity, and apathy, are the leading symptoms. Fainting and epileptiform seizures may occur in both ailments. Multiple hæmorrhages can produce "diffuse" focal signs in arteriosclerosis, like those in Alzheimer's disease. Later stages with incessant restlessness, plucking movements, and severe logoclonic disturbance of speech, are much more characteristic. Emotional reactions are relatively little impaired in Alzheimer's disease in spite of the enormous destruction of intelligence and memory. The control of emotion, so typically defective in vascular cases, is relatively well preserved. On the other hand, the insight of the patient into his defects disappears earlier in Alzheimer's disease.

These are, in rough outline, the contributions of psychiatry to the symptomatology and diagnosis of the two main forms of presenile dementia. As all experts agree that there are other, not yet clearly-defined, forms, one should neither force atypical

cases into one of these forms, nor take a defeatist attitude towards all diagnostic activity in this field.

Is diagnostic effort justified at all, as there is to-day not the slightest hope with regard to therapy? Still, G.P.I. was a similarly hopeless chapter of neuropsychiatry only twenty years ago, and, there, too, knowledge of the structural changes greatly advanced the understanding of the fundamental pathological process at work.

How the morphological changes in the brain are brought about is a much-discussed but unsolved problem. In the literature, as far as I know it, there is very little to be found of the clinical or pathological findings in the total organism, apart from the brain. It seems to me necessary that our knowledge of the general physiology of old age should be applied to the special problems of neuro-psychiatry (Lewy). This might be a promising mode of attack.

The genetics of presenile dementias have been studied as yet only with regard to the familial incidence of the individual diseases. Here again it seems that further progress might be achieved by studying them in relation to the hereditary factors in longevity and early and late senility (Pearl).

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Dr. Macdonald Critchley: A little over six years ago our two Sections met to discuss this self-same problem—the presenile dementias, and upon that occasion the honour of opening the discussion fell to myself. In speaking again on this subject after a period of six years, I might first turn back and review the outcome of that former discussion—to examine its points of utility and its shortcomings. The occasion served to ventilate, almost for the first time in our country, the clinical features of those two obscure disorders, Pick's cerebral atrophy and Alzheimer's psychosis. Unfortunately each speaker on that occasion delivered approximately the same message, and the discussion dwindled to a mere description of Pick's disease and of Alzheimer's disease and of little else.

To-night we have at least been given a second chance—an opportunity to repair some of the gaps which appeared on the previous occasion. The opportunity is also offered us of discussing such advances as have been made during the past six years in our knowledge of the presenile dementias.

In the first place I think we ought to emphasize, as did Dr. Mayer-Gross, that both Pick's disease and Alzheimer's disease are rarities, and I think it should be stressed that they constitute insignificant members of the heterogeneous group of presenile dementias. I therefore suggest that a useful purpose would be served by making some attempt at classification of the dementias in order to relegate these rare forms to their true perspective.

Obviously, there will be an overlap between the presenile dementias and many of the organic psychoses. Nevertheless, the terms are not synonymous, for we are restricted by definition to these types of mental disorder occurring typically (though not exclusively) in the elderly, and furthermore to those psychotic types characterized essentially by dementia, or deterioration in intellectual capacity.

A working classification based on a clinico-ætiological foundation may be given as follows :—

The syphilitic dementias (including "syphilitic encephalitis", luetic cerebrovascular disease, G.P.I., &c.).

Arteriosclerotic dementias.

Traumatic dementias (including also the sequelæ of cerebral laceration; chronic subdural hæmatoma, &c.).

Cerebral tumour (and abscess).

Epileptic dementias (including "neuro-somatic deterioration").

Secondary dementias (supervening upon chronic psychotic or psychopathic states).

Dementia complicating chronic neurological disorders (disseminated sclerosis, epidemic encephalitis, subacute combined degeneration of the cord, Huntington's chorea).

Dementia associated with chronic toxi-infective states (uræmia; lead, alcohol, hashish, barbiturates; pellagra).

Specific dementias of unknown origin: Pick's disease; Alzheimer's disease (presbyophrenia).

Of the foregoing, the arteriosclerotic dementias present themselves most frequently in practice. Syphilitic and neoplastic cases are next commonest. Differential diagnosis is not always a simple matter, and I am still sceptical (as I was six years ago) as to whether it is possible to diagnose during life either Pick's disease, or Alzheimer's disease, except by a process of elimination. Furthermore, I still feel that it is barely possible on purely clinical grounds to distinguish cases of Pick's disease from Alzheimer's psychosis, though I am aware that some psychiatrists make an attempt. Encephalography may prove helpful, of course, for if regions of cortical atrophy are demonstrated, Pick's disease seems to be suggested. Lastly I would again stress the genetic aspect; if a familial occurrence of the same disorder, or of other psychopathic features, can be traced, Alzheimer's disease becomes far less likely than Pick's disease.

Turning now to the question as to what clinical advances have been made during the past six years, I would select for your consideration the work of Goldstein in analysing the activities of patients with organic brain disease.

During recent years this author has patiently evolved a conception of the behaviour in patients with central lesions which is, in my opinion, of the utmost importance. I would suggest, indeed, that Goldstein's work upon the problem of aphasia is the most significant contribution to that subject since the work of Hughlings Jackson. Like Jackson, Goldstein has concerned himself with positive rather than negative manifestation in cases of focal cerebral lesions, and he has been far more interested in the manner whereby the healthy parts of the brain are contriving to act than in a mere description of the purely outfall symptoms.

Goldstein has built up his conceptions mainly upon the Gestalt hypothesis. In this way he has largely been his own worst enemy for no aspect of psychology is afflicted with quite such an unfortunate terminology. It happens, therefore, that Goldstein's views are often obscured by a distressing misuse of words—terms often being employed with ambiguity, imprecision, and in such woolly profusion as almost to conceal the underlying ideas. I feel, nevertheless, that the labour of unravelling the cipher is rewarded by the value of what emerges.

Goldstein studied especially the changes in what he calls the "total behaviour" of patients with cerebral lesions. He points out that their performance cannot simply be described in terms of plus or minus, success or failure. A patient may succeed in a task on one occasion and fail entirely on another. Or one time he may succeed

easily, and—a little later—only with considerable effort. Goldstein asks us to witness the conduct of a demented patient presented with a task well within his competency; the patient does what he is requested with promptness and confidence. When confronted, however, with a demand which is beyond him, he becomes obviously distressed. He looks dazed, agitated; he fumbles anxiously and changes colour; his pulse may become irregular; his mood alters from amiability to sullenness, evasion, or anger. In Goldstein's words there has arisen a "catastrophic situation". In order to bring about an avoidance of these catastrophic situations and to develop an appropriate "milieu" or propitious environment, a complex adjustment of the organism therefore takes place. There are various measures which may be adopted by the demented patient to bring about this "flight from catastrophic situations". One is by dissociation or self-exclusion from the environment, even—in extreme cases—by relapse into unconsciousness. More often, of course, there is a simple avoidance of company and a search for tranquillity, as if he were trying to erect a protective barrier around himself. This idea partly explains the apparent apathy, the lack of co-operation, and the confusion, of the demented patients; herein may also lie the explanation of such disordered activities as carelessness in personal habits and attentions.

Another method of seeking an adequate milieu is by means of a restless overactivity. Everlasting pre-occupation shields the patient from difficult demands or stimuli. We find, for example, a patient with mixed sensorimotor aphasia seeking in an extreme verbosity a means to keep the control of the conversation within his grasp. At a psychomotor level, we recall the numerous and often complicated hyperkinetic movements which are not uncommon manifestations in the dement. We may also note a tendency for the patient to complete a task as quickly as possible.

Another refuge of the early dement is in an excessive orderliness. By means of a meticulous formal arrangement of his belongings the patient can lay his hand upon an article with minimal effort and without the troublesome exercise of choice. A phenomenon of this kind is obviously compatible only with slight degrees of dementia, and with increasing deterioration, such a utilitarian system will break down.

These steps in the adjustment of the dement to his shrunken environment are unconscious processes of course. Goldstein believes that the degree of adaptation is directly proportional to the severity of the defect, a truism which is demonstrable also in such focal symptoms as central blindness or deafness, paralysis, and loss of speech.

Still other steps can be traced in the modified total behaviour of patients with cerebral disintegration. Goldstein affirms that the patient's receptivity is reduced, owing to a rise in the threshold of excitation, but if excitation has occurred, despite the obstacles, it expands and persists abnormally. We see this process exemplified in the ideational inertia, and in the perseveration of speech and of action which such patients often display. The subject, too, is abnormally distractible, but once the attention is secured it becomes fixated unduly long. This is not to be confused with inattention. Having a greatly restricted field of performance, the patient flits from one thing to another until he finds something within his capacity, and then he becomes "tied to the stimulus" as Goldstein says. Again, the patient experiences a constant difficulty in distinguishing essentials from non-essentials, or, in technical terms, in separating "figure" from "background".

Lastly the disordered behaviour and speech of many of the milder dements can best be understood by regarding them as having lost the "ability to assume a categorical attitude" to quote Goldstein's unfortunate phraseology. Thus Goldstein points out that there are two types of human attitude towards the world: (1) A more primitive or *concrete* attitude in which one is directed towards given objects and in which thinking and acting are directed by them. Activity is determined directly by the claims demanded by these objects of the environment; and (2) a higher and

more *abstract* attitude, in which one is first moved to think about the objects and is conscious of them. Actions are then governed not so much by the objects with which one is confronted as by what one thinks about them. To put this more clearly we may remind ourselves that normally we can, if we desire, inhibit or disregard the various attributes of an object and can consider the object independently of its adjectival qualities. In other words we can deal with the concept of say, flowers, independently of any particular type or specimen. By so doing, we can be described as adopting an abstract or " categorical " attitude. In opposition to this is the so-called " concrete " attitude, where ideas can only be considered in relationship to actual objects. We see these two types of attitude dissociated in some of the more primitive languages. For example, among one of the South American Indian communities, a number of different words are used to denote various kinds of parrots —large ones and small, male and female, young and old, grey, green, and blue ones, &c.—but there is no one generic term to stand simply and solely for " parrots ".

The dement in the early stages typically loses his power of abstract thought and behaviour and can cope solely with the concrete.

A number of clinical illustrations could be given of this loss of categorical attitude or behaviour. A patient may successfully engage in knitting or needlework—a concrete activity—but when interrupted with the request to show the examiner the handiwork, she becomes confused and helpless. Asked to fetch a comb from off the dressing-table, she picks up the comb and then uses it on her own hair. Told to bring a pencil, she sits down and writes with the pencil on a sheet of paper until she is checked. She is unable to indicate in dumb-show how a key is employed, but given a key she goes promptly to the door and locks it.

By realizing that the dement early loses the power of changing his attitude, from the elementary passive type of concrete behaviour to the more active, higher, abstract realm of performance, one begins to understand many apparent inconsistencies in our patients : " On the one hand, abnormal excitability, unrest, distractibility and lack of interest, bad memory, lack of orientation in space and time, and on the other hand, dulness, lack of initiative, abnormally fixed attention, an intense tendency to cling to some objects or actions, and good memory in certain situations " (Goldstein).

I must emphasize again that Goldstein's observations dealt particularly with patients afflicted with focal lesions of the brain. Nevertheless the approach is one which can also be employed with advantage in early cases of dementia, where the cerebral lesions are multiple or are thinly spread throughout the hemispheres. Goldstein himself essayed a psychopathological study of a presumed case of Pick's disease, and hazarded the opinion that the lack of categorical attitude was an important diagnostic feature, as suggesting bilateral frontal atrophy.

Dr. J. G. Greenfield : In those forms of mental disease in which the activities of the mind are perverted rather than reduced, the search for histological changes in the brain has proved disappointing. This should no doubt have been expected, since these disorders are probably determined by metabolic disturbances in the cerebral cortex which our present methods cannot assay.

But it was reasonable to expect that some histological changes would be found in the cerebral cortex in cases of dementia. This hope has encouraged much careful study, especially in Germany, with results which are evident if we look at the enormous literature dealing with the histopathology of the brain which has been appearing of recent years.

While there is a considerable disproportion between the enormous labour and energy expended and the results achieved, there has been a very definite increase of knowledge. The discovery of lesions in the brain and their classification make, of course, only one step in the determination of their ætiology, but surely a necessary step if any

scientific progress is to be made. The most satisfactory classification would be one based wholly on ætiology, and to a limited extent this is possible. But there are still several forms of lesions of the brain tissue causing presenile dementia which we can differentiate on histological grounds, but whose cause is at present unknown.

I shall confine my remarks to the forms of presenile dementia associated with vascular disease, with tumours and hydrocephalus and with progressive disease of the cerebellar system.

Vascular disease of the brain may be divided into : (1) Cases with evident softenings or hæmorrhages. (2) Cases of granular or verrucose atrophy of the cortex. (3) Cases in which the predominant or perhaps the only changes are " areas of paling " not visible on naked-eye examination.

(1) In the most common form of cerebral vascular disease associated with presenile dementia we have little difficulty in tracing both the cause and the effects of the disease. The arteries at the base usually show patchy or diffuse arteriosclerotic changes in varying degree. On removing the pia arachnoid and sectioning the brain, we find multiple areas of cortical destruction appearing either as localized foci in which the cortex is punched out, or as shrinkage and brownish discoloration of the cortex over rather wider fields, usually affecting several neighbouring convolutions. Associated with this there may be numerous areas of softening of the white matter. But sometimes the disease, on naked-eye examination at least, appears to be confined to the cortex. On the other hand there is the form of disease described by Binswanger, in which the chief brunt of the lesions falls on the white matter.

The variations in this pathological picture are innumerable, and little is to be gained by attempting to describe them all or in giving different names to forms in which the predominant change is of one or other character. It is to be noted, however, that small cortical softenings or recent infarctions are frequently seen when the vessels at the base show no evident disease and when no thrombosis of smaller vessels can be made out. A rare variant of lesion in the brain, associated with hyperpiesis and dementia, is the presence of multiple small slit-like hæmorrhages, chiefly in the white matter just under the cortex. It is easy to see how such hæmorrhages might reduce mental powers by undercutting the cortex and severing the connexions between one part and another. Why in this form, and in the subcortical encephalopathy of Binswanger, the chief lesion falls on the long vascular branches going to the white matter is not clear, but their pathogenesis is no doubt related to the relative absence of anastomoses in these vessels.

(2) Verrucose or granular atrophy of the cortex is usually associated with a similar change in the cortex of the kidney, and with hyperpiesis. The change affects larger or smaller areas of the cortex, sometimes only single convolutions here and there, sometimes whole lobes. In a case which I recently examined it seemed to be greatest in the areas of cortex which lie at the junction of vascular supply of two of the large arteries, i.e. over the outer surface of the frontal and parieto-occipital regions. In this case the larger arteries at the base of the brain were quite healthy. The degeneration affects in an irregular manner both the nerve-cells and fibres in the cortex, and is associated with an overgrowth of neuroglial fibres. It appears to depend on sclerosis of the small cortical arterioles similar to that found in the kidneys and elsewhere in the body.

(3) A form of progressive vascular disease of the cortex has recently been recognized in which no naked-eye changes are present either in the vessels or in the texture of the brain, apart from slight thinning of the cortex of some convolutions. The patients have usually had a high blood-pressure during life and may have shown other evidence of arteriolar disease. Microscopical study of the cortex shows a varying degree of intimal proliferation in the small cortical vessels associated with focal rarefaction of the nerve-cells, or " areas of paling " in which all the nerve-cells are more or less degenerated. Very often this is the only change ; there is little

proliferation of neuroglial nuclei or fibres and no microglial reaction, but the endothelium of the capillaries often shows some proliferative activity. These areas are fairly sharply defined, so that within a millimetre or so one passes from a diseased to a perfectly healthy area of cortex. It is not difficult to pick out these areas on examination of Nissl sections with a very low-power objective, but they are very easily missed if one uses for examination ordinary objectives such as $\frac{2}{3}$ and $\frac{1}{6}$ in., and sections stained with hæmatoxylin. These "areas of paling" are usually widely scattered and quite numerous. In fact it seems doubtful if they would produce mental deterioration unless they affected a considerable amount of cortical tissue, as one finds them more localized or less numerous in many brains from cases without mental impairment.

This form of cortical damage is closely allied to that found in Kraepelin's presenile psychosis, in which perhaps the changes tend to be more diffuse, and it appears to be the basis of mental deterioration associated with epilepsy. In the latter cases Sommer's sector in the hippocampus and the Purkinje cells of the cerebellum are usually severely affected.

Granular atrophy of the cortex may of course be combined with "areas of paling" in areas of the cortex which appear normal on naked-eye examination. But both types of change may occur in almost pure form, and both may be found when the larger arteries show no evidence of disease.

Cerebral tumour.—Dementia is an important part of the symptomatology of many forms of cerebral tumour. But in most cases the somatic symptoms predominate over the mental and the question of primary mental disease does not arise. It is only in the case of slowly growing tumours which either affect commissural tracts rather widely or produce hydrocephalus that mental symptoms predominate from the outset. Gliomas of the corpus callosum, whether situated anteriorly, posteriorly, or throughout its extent, are recognized causes of mental symptoms and slowly growing tumours of the 3rd ventricle, especially when they produce hydrocephalus, may produce few symptoms except progressive dementia. Smyth and Stern recently pointed out the frequency of early symptoms of dementia in tumours beginning in the medial nucleus of the thalamus. There is also a diffuse form of glioma of the hemispheres, allied in histological appearance to pontine gliomas, which may produce the clinical picture of organic dementia without focal signs. In some such cases naked-eye examination of the brain does not at first suggest the diagnosis of cerebral tumour. The same is true for certain cases of meningeal infiltration by sarcoma or carcinoma in which mental deterioration may be the most prominent, or the only, symptom, apart from those of intracranial pressure. In such cases the slight thickening of the meninges and distension of the ventricles may readily be overlooked or passed as due to slight chronic meningitis.

One such case, which was examined last year at the National Hospital, was at first very puzzling. A woman aged 58 showed a progressive lack of interest and drowsiness and carelessness in her dress and general behaviour over a period of ten months. Five months before admission to hospital she began to have headaches and vomiting and complained that her vision was not so good as before. She was admitted, under Dr. C. P. Symonds, to Guy's Hospital where it was noted that her cerebral functions were slow and her speech slow and uncertain, and that she was disorientated. Bilateral papillœdema was also found. The cerebrospinal fluid was examined and found to contain 70 mgm. % protein but to be otherwise normal. She was transferred to the National Hospital, with the tentative diagnosis of cerebral tumour. There the fundi were passed as normal by the ophthalmologist and no abnormal physical signs were made out except a doubtful Babinski response on the right side. Ventricular taps showed that the fluid in either lateral ventricle contained 180 mgm.% of protein and a few cells. A second ventricular puncture was made a week later with a similar result, and this time the lumbar fluid was also examined and found

to be straw-coloured and to contain 560 mgm.% protein. No further operative treatment was undertaken.

At the post-mortem examination the brain and the lateral ventricles appeared quite normal except for a little thickening of the meninges over the Sylvian point. There was, however, a mass of cancer at the hilum of the left lung. Microscopical examination of the cortex in this case showed a diffuse infiltration of the meninges by cancer cells which passed into the cortex along the small vessels. An irregular layer of cancer cells was also found overlying the ependyma of the lateral ventricles. In this case the examination of the ventricular fluid gave the first and the only definite evidence that the case was one of cerebral tumour.

The other group of cases to which I wish to refer is that of cerebellar and olivo-ponto-cerebellar degeneration associated with progressive dementia. This association has been pointed out by Guillain and Bertrand, van Bogaert and Schroeder and Kirschbaum among others. An interesting family in which both cerebellar and mental symptoms occurred has recently been reported by Akelaitis. The pathological changes in the cortex in the cases which have been examined consist of diffuse loss of nerve-cells, a loss which may be very difficult to assess, although in some cases definite degenerative changes in the larger pyramidal cells have been found. In two cases of subacute spinocerebellar degeneration, which I recently reported, mental symptoms were very evident, in one case progressing to complete dementia. But I was unable in these cases to demonstrate any definite abnormality in the cerebral cortex. It is probable that we are here dealing with a form of primary neuronal degeneration in which the cerebral cortex suffers along with, though much less severely than, the cerebellum and brain-stem.

Cases of this kind illustrate the difficulties which arise when we try to correlate the degree of mental deterioration with that of neuronal destruction. The cortex covers a huge area which we can only sample here and there, and it is extremely difficult to say, in many cases, whether the nerve-cells are as numerous as they should be. There is also, no doubt, a personal factor, in that patients differ in their power to sustain loss of cortical neurones without showing mental symptoms, and in spite of much work, and still more speculation, we are still completely ignorant of the relation of cortical architectonics to mental processes. Another question which is raised by pathological studies is whether disease of the thalamus alone may produce, if not typical dementia, at least considerable confusion and alteration of mental tone. Some cases of cerebral tumour and of disease of the basal ganglia would suggest that this is a possibility. But until the gulf between physiology and psychology is more completely bridged, all that pathology can do is to demonstrate lesions in the brain and to leave their correlation with mental symptoms to the future.

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Dr. Alfred Meyer: In 1920 and 1923 Alphons Jakob described a group of peculiar cases which were clinically characterized by a combination of psychotic, extrapyramidal, pyramidal, and even peripheral, motor phenomena, and pathologically by degenerative lesions in cortex, basal ganglia, brain-stem, and in several cases, in the spiral anterior horn cells and their equivalents in the medulla. This group has become known as Jakob-Creutzfeld disease. Since chiefly persons in middle and higher age are affected, and since nearly all cases hitherto described have

been observed in mental institutions, there is ample justification for including this group in a discussion on presenile dementias. The psychosis has aroused particular attention, because it is a progressive organic dementia, often exhibiting marked catatonic and paranoid features.

In view of the extremely wide distribution of the lesions, it is to be expected that the cases of this group vary considerably among each other. There is also no really significant criterion of the pathological process. It is said to be degenerative and lacking inflammatory or gross vascular lesions. The presenile feature of argentophilia is missing, but beyond these negative points there is, apart from the distribution, nothing which clearly delineates these cases from other so-called degenerative conditions. It is even doubtful whether the cases described under this heading form a nosological entity. There is no doubt, however, that cases with the symptomatology outlined by Jakob and subsequent writers really exist, and as they cannot be classified among other well-defined disease entities, Jakob's grouping may be accepted as a provisional scheme of heuristic value.

Two personal cases which are considered to belong to this group have just been demonstrated. The first has been already published as a combination of amyotrophic lateral sclerosis with psychotic disturbances (progressive dementia with catatonic features). The second case will soon be published in collaboration with the staff of Banstead Hospital, where it has been observed clinically. Thanks are due to Dr. Petrie, who kindly gave permission for the demonstration of this case which, in clinical as well as pathological features, is strikingly like the first one.

Since cases of this kind are chiefly found in mental institutions, it is well worth while for the psychiatrist to know of their existence and to bring suspect cases to the notice of the pathologist.

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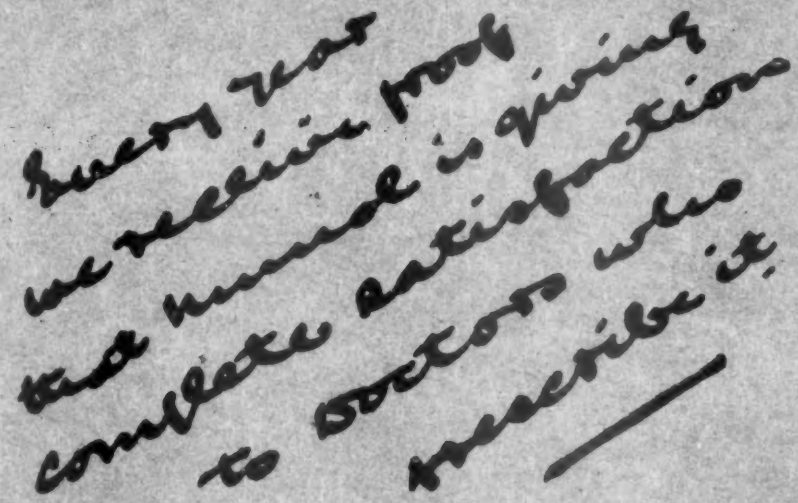

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